Business Proposal

Predicting compatibility of crop types with the changing climate



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# Introduction

The impact of climatic changes on agriculture is mainly caused by changes in solar radiation, temperature and precipitation, which are the main drivers of crop growth. Therefore, agriculture has always been highly dependent on climate patterns and variations. Projections have been made regarding the significant impact of climate change on agricultural conditions, food supply and food security. Even so, no application exists to serve as an adaptation strategy against the impact of near-future climate changes.

## Business Model

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| PROBLEM   * Access to information | SOLUTION   * Mobile Application conveying local crop information | UNIQUE VALUE PROPOSITION   * Save time on crop research * Remove need for processing large volumes of data for small scale use | | UNFAIR ADVANTAGE   * Novel idea * Based on open data | CUSTOMER SEGMENT   * Governmental agencies * Rural subsistence farmers   Early Adopters   * Developing Country governmental agencies |
| KEY METRICS   * Site visits * Downloads * Created open data set * Open source data | CHANNELS   * Government agricultural agencies * Twitter * Distribution through CTA * Agricultural supply suppliers |
| COST STRUCTURE   * Data hosting (currently free) * Website (currently free) | | | REVENUE STREAMS   * Agreements with Governmental agencies will define the costs based on specifications. * The mobile application will be freely available and the website can also be accessed at no cost to the end user | | |

## Biodata of the Promotors

|  |  |
| --- | --- |
| Name | Victoria Rautenbach |
| Date of Birth | 01/12/1987 |
| Age | 27 |
| Qualifications | * BSc. Computer Science * BSc. (Hons) Geoinformatics * MSc. Geoinformatics * PhD. Geoinformatics (in progress) |
| Affiliation | Centre for Geoinformation Science (CGIS) |
| Responsibilities | Developer  App development and design |

|  |  |
| --- | --- |
| Name | Sean Paul Edward Cullen |
| Date of Birth | 07/03/1991 |
| Age | 24 |
| Qualifications | * BSc. Geoinformatics (2010-2012) * BSc. (Hons) Geoinformatic (2013) * MSc. Geoinformatics (in progress) |
| Affiliation | Centre for Geoinformation Science (CGIS) |
| Responsibilities | Data analysis and maintenance  Logo design  Website design |

|  |  |
| --- | --- |
| Name | Nadia Oosthuizen |
| Date of Birth | 02/10/1991 |
| Age | 24 |
| Qualifications | * BSc. Geography (2010-2013) * BSc. (Hons) Environmental Assessment and Management (2014) * MSc. Hydrology (in progress) |
| Affiliation | CSIR |
| Responsibilities | Data sourcing and data collection  Logo design  Business proposal writing |

|  |  |
| --- | --- |
| Name | Danie Jooste |
| Date of Birth | 25 |
| Age | 20/03/1990 |
| Qualifications | BSc. Geoinformatics  BSc. (Hons) Geoinformatics (in progress) |
| Affiliation | Centre for Geoinformation Science (CGIS) |
| Responsibilities | Developer |

# Map design and prototype development

The aim of the app is to provide the end user with the necessary information needed to plan for future crop farming. Open source temperature, precipitation and crop data were analysed and used to predict how various crop types will be influenced by climate change. The maps are the core of the website as well as the mobile application, therefore any other data displayed (on the website) were specifically selected due to their inter-relatedness to the displayed data. Both the website and mobile application was created to assist decision makers as well as local farmers in decision making regarding future crop farming.

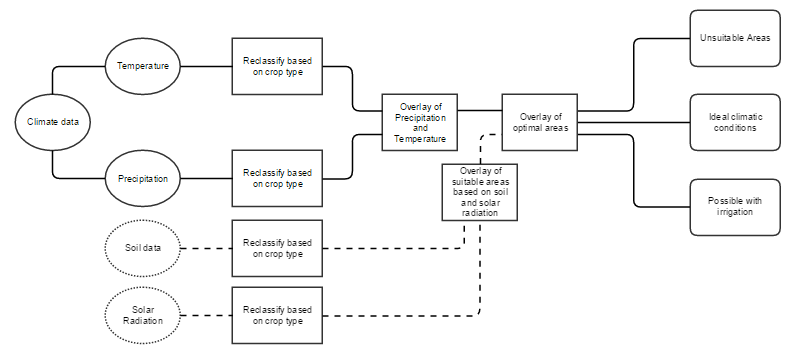


Figure 1: A model showing the steps that were followed to create the base maps for the website and mobile application.

## Problems that the website and mobile application will address

### How can production and income be increased?

The app can help with production increase as well as possible income with the information it provides. It is specifically aimed at governmental agencies that can use the information to improve the livelihood of rural communities and/or redistributed land claimants. Therefore, the government can, for example, use the website to see what crop type will be ideal for planting in a given area over a given time period. This can ensure that crops are still produced, regardless of changes in climate. It should be noted that focus weren’t placed on commercial farmers (even though they can also use the app and/or website) since the farmers are already well established and changes in crop type, especially over large areas, can become very expensive. However, commercial farmers can make use of the information to plan for the future especially if their crops might be affected by climate change.

### How can year-round production be maintained?

The results produced for the application and website is not at a seasonal scale (mean annual data is used instead), therefore year-round production cannot be determined without some form of uncertainty. However, it is possible to create seasonal scale maps/outputs and will be focused on when the app is developed further.

### How can competitiveness with regards to international prices be achieved?

This application will be freely available; therefore there will be no need to become competitive with regards to international prices.

### How can the nutritive quality of the food produced be achieved and how can food security be improved?

The app will help with food security, but the nutritive quality is beyond the scope of the app. Food security will be ensured if the information provided by the website and/or mobile application is applied to decision-making process regarding crop planting and aid provision for subsistence farmers and other small scale farmers etc.

### How can agricultural production be used to increase employment levels?

Increased production is usually associated with increased employment levels. However, high levels of future unemployment (specifically farm workers) could be possible if climate change led to crop production decrease. Therefore, both website and mobile application would not necessarily lead to an increase in employment levels due to crop production. Instead, employment security could be ensured is the recommended crop types are planted since crop growth is ensured.

### How can the information, practices or challenges identified in the available documents be mapped?

The climate and crop data can be processed and geographically displayed in the form of maps. The maps can be viewed in both the website and mobile application.

**Data Sources used**

Focus was placed on the data provided by CCAFS as well as the other sources (listed by CTA for the Hackathon).

Table 1: The various open data sources from which data was downloaded to process and display in the website and mobile application.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Data Source** | **Data Type** | **Resolution** | **Period** | **Reference** |
| GCM Downscaled (GCM data portal) | Climate | 2.5 arc-minutes | 2010-2039  2020-2049  2030-2059 | <http://www.ccafs-climate.org/data/> |
| FAO | Crop data | 8 km | n.a | <http://www.fao.org/geonetwork/srv/en/metadata.show?id=37139&currTab=distribution> |
| FAO | Crop properties | n.a | n.a | <http://www.fao.org/nr/water/cropinfo.html> |
| Agtrails | Crop information | n.a |  | <http://agtrials.org/> |
| WorldBank | Rural Population | n.a | 1960-2014 | <http://data.worldbank.org/topic/agriculture-and-rural-development> |
| Free Photos | Photos | n.a | n.a | <http://all-free-download.com/free-photos/> |
| Fotosearch | Photos | n.a | n.a | <http://www.fotosearch.com/photos-images/alfalfa-crop.html> |
| Weather underground | Durban average temperature and precipitation data | Recorded daily averages | November 2014 to November 2015 | <http://www.wunderground.com/> |

## Data Sources that were considered, but not used

The following data sources were considered during the data collection phase, but were not used due to various reasons (see Table 2).

Table 2: Data sources that were considered during the data collection process.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Data Source** | **Data Type** | **Resolution** | **Reference** | **Reason** |
| Adaptation and Mitigation Knowledge Network | Various | n.a | <http://amkn.org/#/bm=basemap_6/ctr=4628280.715140242;968867.4464045139/lvl=3/pts=ccafs_activities,ccafs_sites,biodiv_cases,amkn_blog_posts,photo_testimonials,video_testimonials>, | The data needed could not be downloaded (in shape format). Specific data that we wanted do download is the soil data. |
| CGIAR and CCAFS Hackathon | CCAFS Household Baseline Survey 2010-12 | n.a | <http://hackathon.ccafs.cgiar.org/portfolio/baseline-survey/> | Data is not part of our scope. |
| Terra-i An eye on habitat change | Near real-time land cover or habitat change monitoring | n.a | <http://www.terra-i.org/terra-i.html> | Data is not part of our scope. |
| MAPSPAM | Global Data | n.a | <http://mapspam.info/global-data/#sort/yield/total> | We were looking for data that is more recent than 2005. |
| Global Biodiversity Information Facility | Biodiversity data | n.a | <http://www.gbif.org/> | Data is not part of our scope. |
| Genesys  Gateway to Genetic Resources | Genetic resources | n.a | <https://www.genesys-pgr.org/welcome> | Data is not part of our scope. |

## Articles used

Data that is available for download sometimes lacked information that we needed; however the need to source data elsewhere was minor. Some of the listed articles were also used to gain some understanding about certain topics and/or crop types.

Table 3: Articles and other websites used to source data that is missing from the data sources displayed in

Table 1.

|  |  |  |  |
| --- | --- | --- | --- |
| **Author** | **Title** | **Year Published** | **Reference** |
| Ramirez-Villegas, J. and Jarvis, A. | Downscaling Global Circulation Model Outputs: The Delta Method Decision and Policy Analyst Working Paper No.1. | 2010 | <http://www.ccafs-climate.org/documentation/> |
| Queensland Government: Department of Agriculture and Fisheries | Varieties and planting of maize | Last updated on 30 July 2012 | <https://www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/maize/varieties-planting> |
| The Samuel Roberts Nobel Foundation | Common mistakes in growing Alfalfa. | September 2009 | <http://www.noble.org/ag/soils/growingalfalfa/> |
| UMassAmherst | Soil Testing for Grapevines | June 2013 | <https://soiltest.umass.edu/fact-sheets/soil-testing-grapevines> |
| CSIR – Savanna Agricultural Research Institute (SARI) | Groundnut Production Guide | 22 July 2014 | <http://csirsavannah.blogspot.co.za/2014/07/groundnut-production-guide.html> |
| A. Oelke, E.S. Oplinger, T.M. Teynor, D.H. Putnam, J.D. Doll, and K.A. Kelling, B.R. Durgan, and D.M. Noetzel | Safflower | 1992 | <http://corn.agronomy.wisc.edu/Crops/Safflower.aspx> |
| SA Olive Industry Association | Climatic and Soil Requirements | n/a | <http://www.saolive.co.za/olive-growing/technical-information/climatic-soil-requirements> |
| BBC Gardening Guides | Growing Cabbage and brassicas | 2014 | <http://www.bbc.co.uk/gardening/basics/techniques/growfruitandveg_growingbrassicas1.shtml> |
| NETAFIM Irrigation | Onions Best Practices | 2015 | <https://www.netafim.com/crop/onion/best-practice> |
| The world’s major Crops | Production and area harvested of world's major crops in 2001, ranked by production (Sourced From FAOStat Agriculture Data) | 13 Nov 2002 | <http://keys.lucidcentral.org/keys/sweetpotato/key/Sweetpotato%20Diagnotes/Media/Html/TheCrop/AboutTheCrop/WorldCropStatistics.htm> |

## Open Source Software used

The data processing, mobile application and web design were all done by mainly using open source software. However, the use of open source software did lead to some restrictions, mainly being a lack of storage space. Therefore, we were restricted to displaying only 4 maps on our website and uploading all of our maps were not possible without payment.

Table 4: A list of open source software that was used during the development phase as well as the design of the website and mobile application.

|  |  |
| --- | --- |
| **Software Name** | **Activity** |
| QGIS | Data Processing |
| WIX.com | Website design |
| Ionic | Mobile Application |
| Cesium | Creating 3D maps |
| NoGIS |  |
| Cordova | Java scripting tool |
| AngularJS | HTML enhancement for web apps |
| CartoDB | Data mapping |
| D3JS | Graphical displays (tool used = VIDA) |
| PostGIS | Spatial querying |
| PostGres | Spatial querying |