Walk Less Model

Optimizing operations – where is the best location to work?

# background

We used project data combined with location information to decide whether to move our project activity locations so that people would be required to walk less. This increases accessibility and higher participation rates as it better optimizes project activity locations, which translates into people having to give up less working time and increased participation to go pick up goods. Typically, the poor are very busy, so the closer the project or program activities take place to their locations, the higher the participation rates we see. The poorest of the poor live in some of the hardest to reach places, and if you want to get to them, we must locate our projects and programs more efficiently. The objectives of this tool are to:

* Identify the shortest path from start points to destination points taking into consideration the slope
* Calculate the shortest distance from start points to destination points
* Calculate the walking time from start points to destination points

# reference/s

* This model was used in different country programs:
* Nigeria: The LLIN (Long-Lasting Insecticidal Nets) Campaign in Nigeria used household locations to estimate where to locate distribution points or if more distribution locations are needed. Improving project participation in net retrieval is essential in the reduction of malaria.
* Ethiopia: As part of the 2016 El Niño Drought Response, the program conducted a terrain analysis by the smallest administrative area (Woreda) to help decide where to distribute emergency aid.
* Madagascar: The Fararano Project used predictive analysis tools for optimizing food distribution locations to minimize the distances women and children had to travel to receive aid. You can check additional information here [Let's Stop Asking People to Walk All Day: A Call for Easily Accessible Walk Time Estimation](https://geographic-information-system.cioreview.com/cxoinsight/let-s-stop-asking-people-to-walk-all-day-a-call-for-easily-accessible-walk-time-estimation-nid-24518-cid-52.html) & [Predictive Analysis Brings Food Aid Closer in Madagascar](https://www.esri.com/about/newsroom/arcuser/predictive-analysis-brings-food-aid-closer-in-madagascar/?rmedium=esri_com_redirects01&rsource=/esri-news/arcuser/spring-2017/predictive-analysis-brings-food-aid-closer-to-madagascar)

# methodology

## requirements

* ArcGIS Pro License - request through [ServiceNow Form](https://crsprod.service-now.com/ess_portal/com.glideapp.servicecatalog_cat_item_view.do?v=1&sysparm_id=40ae17fc1be32410c66b8730604bcb8d&sysparm_link_parent=578a0c00db1bd700bb3f400e0b9619d7&sysparm_catalog=e0d08b13c3330100c8b837659bba8fb4&sysparm_catalog_view=catalog_default)
* Geographic Area of Interest in GIS format (.shp polygon)
* [Digital Elevation Model (raster)](http://earthexplorer.usgs.gov/)
  + In “Search Criteria” tab enter the coordinates around the project location and they will appear in the map to the right. You can also navigate to the respective area in the map and click on “Use Map” button.
  + In “Data Sets” tab click on Digital Elevation à SRTM à SRTM 1 Arc-Second Global. Here you will be able to download the data, save it to a folder and upload it to ArcMap. NOTE: You may have to create a user profile in USGS to download the data.
* GPS Data or Locations of Households/Beneficiaries or building footprint from Eccopia
* GPS Data or Locations of Distribution Location(existing or planned)
* OPTIONAL (any other parameters important for your specific project if available)
  + Satellite imagery for base map (you can use base maps available in ArcGIS Pro)
  + Waterways Data – to add as an obstacle criterion where people cannot pass.
  + Road Networks – didn’t consider as an initial input because the DEM data can process areas that serve as possible road networks.
  + High-slope Mountains – to add as an obstacle criterion where people cannot pass.
  + Non-passable areas (e.g., military areas) – add this by delineating areas that aren’t passable.

*Note: You can add other serviceable facilities data (transportation, evacuation centers, etc.) and customize depending on your needs.*

## technical process (WITH HOUSEHOLD LOCATIONS)

### ARCGIS PRO

Step 1 – Create a new project

* Graphical user interface, text, application, email

  Description automatically generatedCreate your new project by opening ArcGIS Pro and then select New > Blank Templates > Map. Input the name of your new project and select the location folder you want it saved.
* Graphical user interface, application

  Description automatically generatedWhen you create a new project, it automatically creates a geodatabase where it saves your projected and result files.
  + Projected files are your pre-processed input data according to a common coordinate system.
  + Result files are your output data once you run the model.

Step 2 – Access the model

* Download the toolbox model here: [Walk Less Model.atbx](https://crsorg.sharepoint.com/:u:/s/TM-DataTeamMeeting/ESZguiDPnFhLkI4lspwKs60BlesbFAK6Byh8F7d0c8XHjA?e=lTefOA)
* Go to Catalog Pane by going to **View** tab > **Catalog Pane** > right click on **Toolboxes** > select **Add Toolbox** > add your downloaded toolbox model named **Walk Less Model.atbx**.
* Graphical user interface, text, application

  Description automatically generatedOnce added, click on the dropdown under the Walk Less Model.atbx and then double click on the **WalkLessSimple** model.
* Once open you’ll see the blank parameters below.
  + Input\_DEM: **Digital Elevation Mode**l for the study area. You need to clip your DEM raster according to your study area by going to **Analysis** tab > **Tools** > **Clip Raster (Data Management Tools)**.
    - Graphical user interface, application

      Description automatically generatedInput Raster: **DEM**
    - Output Extent: **Study Area (.shp polygon)**
    - Rectangle: *\*auto-populates once study area is added\**
    - Output Raster Dataset: *\*name of your output data and save it in your geodatabase\**
    - Leave all others blank and then hit **Run.**
  + Graphical user interface, application

    Description automatically generatedStart\_points: **GPS Data or Locations of Households/Beneficiaries**
  + Destination points: **GPS Data or Locations of Distribution Location** (existing or planned)
  + Table Name: [ToblerTowards.txt](https://crsorg.sharepoint.com/:t:/s/TM-DataTeamMeeting/ESqbIcFG7CVEmaS7B6SNNCoBZihLCbAIAW7uEBYuaOdNzw?e=ap0Bum)
  + Wlkpath\_withsite and Final\_Result are output data. Click the folder and look for the geodatabase you created in Step 1 (Walk Less.gdb) > click it and then input your desired output name and click Save. Do this for both.

Step 3 – Final Result

* **Wlkpath\_withsite.shp** (or however you named it) – is an intermediate output added to the map that shows the walk path of household/beneficiary point to site.
* **Final\_result.shp** contains points with the following information:
  + Time to go to the destination point: PathCost column (in hour, PathCost x 60 if we want to convert in minutes)
  + The nearest destination point: point\_site column
  + The distance between each start point to the destination point: LENGTH column (km)

Table

Description automatically generated

## technical modifications

1) For the simple model described in the .ppkx file

Project package name in AGOL : **wlk\_model\_simple.ppkx**

Link : [https://crsorg.maps.arcgis.com/home/item.html?id=54a0dccddc444104a1894bcb9ce1670a](https://nam11.safelinks.protection.outlook.com/?url=https%3A%2F%2Fcrsorg.maps.arcgis.com%2Fhome%2Fitem.html%3Fid%3D54a0dccddc444104a1894bcb9ce1670a&data=04%7C01%7Cjaneenkim.cayetano%40crs.org%7C1d4c6ba5dd1046f4ba5008d9d744735a%7Cb80c308cd08d4b07915c11a92d9cc6bd%7C0%7C0%7C637777511256540593%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000&sdata=8aWeCNfZsKadJU0oPS1I3TNEJ3AN%2FLWHmJdDMj%2BuHYE%3D&reserved=0)

2) For the model with obstacles like high montain or river...

Project package name in AGOL : **WLK\_model\_project\_package.ppkx**

Link : [https://crsorg.maps.arcgis.com/home/item.html?id=6566fec0355c4e3d85194c672027ed64](https://nam11.safelinks.protection.outlook.com/?url=https%3A%2F%2Fcrsorg.maps.arcgis.com%2Fhome%2Fitem.html%3Fid%3D6566fec0355c4e3d85194c672027ed64&data=04%7C01%7Cjaneenkim.cayetano%40crs.org%7C1d4c6ba5dd1046f4ba5008d9d744735a%7Cb80c308cd08d4b07915c11a92d9cc6bd%7C0%7C0%7C637777511256540593%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000&sdata=Now4fnatTpFJ%2F3mlXVJUOMuGfKO2phsF%2FpJ8shk%2BqG8%3D&reserved=0)

# planning

## technical costs

* Staff Support
  + Data and Geospatial Analytics Team provides **Spatial Analytics** support with **no charge back** for work < 80 hours. Fill out an [**ICT4D Services Support Request Form**](http://bit.ly/2CUNGLZ)for us to discuss over a call.

## time frame

* Data Requirements
  + Household GPS Locations: 1 day to 1 week (data preprocessing and cleaning by CP or Project Team)
* Data Setup in ArcGIS Pro: 1 to 3 days
* Data Setup in ArcGIS Online: 8 hours to 1 day
* Run Setup: 1 hour to 1 day (depends on building data and HH GPS size)