OpenNSPECT 1.2 Data Acquisition and Preprocessing:
Instructions for Your Watershed

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National Oceanic and Atmospheric Administration (NOAA)
Coastal Services Center

An Open-Source Version of the
Nonpoint Source Pollution and Erosion Comparison Tool

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OpenNSPECT uses spatial elevation data to calculate flow direction and flow accumulation throughout a watershed. To do this, land cover, precipitation, and soils data are processed to estimate runoff volume at both the local and watershed levels. Coefficients representing the contribution of each land cover class to the expected pollutant load are also applied to land cover data to approximate total pollutant loads. These coefficients are taken from published sources or can be derived from local water quality studies. The output layers display estimates of runoff volume, pollutant loads, pollutant concentration, and total sediment yield.

This tutorial steps through the procedures to acquire and process the OpenNSPECT tool's primary input spatial data: elevation, land cover, precipitation, and soils. It is written for OpenNSPECT, version 1.2, hosted by MapWindow GIS, version 4.8.

Processing Considerations

Study Area

Determining a study area starts with an area of interest. This may be an institutional or political boundary or some environment of concern, whether it be on land or near shore. What these areas have in common are their existence within a watershed, or the fact that they receive effluent from a nearby watershed. When determining a study area, one will typically be interested in the upstream extent of watersheds that flow through the area of interest, and the extent of streams flowing to the nearest receiving body of water. The extents of basins, watersheds, and stream flow are derived from the input elevation data.

When acquiring elevation data, be sure to obtain an area large enough to include all watersheds and streams that fall within the expected study area. Instructions for defining a study area based on elevation data are in the section "Determine a Study Area Boundary."

Raster Resolution

Raster resolution is the width and height of the cells in the raster data. Study area size and raster resolution will determine storage size and processing speed for the OpenNSPECT database. It is wise to work with the raster resolution that best fits the input data and study area size. Most often this will be 30 meters for national-scale data.

Typical raster resolutions for OpenNSPECT input data include

- 30-meter land cover
- 30-meter and 10-meter elevation
- 4-kilometer and 800-meter precipitation
- To a lesser extent, 3-meter land cover and elevation data

Data Units

When working with continuous data, it is important to consult metadata to determine the units of measure. It may also be necessary to convert these units to another measurement system. Two of the input data sets, elevation and precipitation, are delivered as continuous. Vertical units in the elevation data are frequently feet or meters; OpenNSPECT handles both of these. Units of Accumulation in the precipitation data are typically millimeters, centimeters, or inches. OpenNSPECT only handles centimeters and inches for precipitation; therefore, unit conversion would be necessary for data delivered in millimeter units. If necessary, convert unit values using the Change Grid Format command.

Data Formats

MapWindow GIS, the open-source software that hosts the OpenNSPECT tool, works with many raster and vector formats. The primary formats used in these instructions are vector Esri shapefile and raster GeoTIFF. Additional formats used when importing data are GridFloat and Band Interleaved by Line. Output raster data will be in GeoTIFF format.

Another data consideration is the grid data type. MapWindow GIS prefers *Integer* data over *Byte* data. Before running an OpenNSPECT analysis, it is helpful to open these to confirm that MapWindow can identify the raster values. If it does not, change the grid data type using the Change Grid Format command.

No Data Values

Background pixels in a raster data set are typically represented by a No Data value. The value is a number outside of the meaningful data range such as -9999 in a precipitation raster. MapWindow GIS lists this under Nodata Value in Layer Properties. MapWindow GIS may not recognize a No Data value if it is changed by some data conversion. For example, converting precipitation units from millimeters to inches would also change the background pixel values by the same multiple. The new No Data value can be identified in the Layer Properties by locating the minimum or maximum value that falls outside of the meaningful data range. The new No Data value can be assigned to the raster using the Change Nodata Value command.

Data Projection

When starting to build an OpenNSPECT database, first determine the most appropriate projection. If a vector boundary file exists for the area of interest, use that projection or convert it to the desired projection. When identifying input spatial data, be sure to take a look at the metadata and identify the data's projection. This may be a default geographic file, or you may be able to define the desired output projection during the download process. When available, it is helpful to download data in your working projection. Open downloaded data in a new MapWindow GIS session to see if MapWindows recognizes the projection information. If it does not, assign the file projection information using the Assign Projection to Shapefile or Assign Projections to Grids commands.

Soils Database – Editing

When preparing a soils database for use in OpenNSPECT, two modifications may be necessary; one addresses dual hydrologic classes and the other fills in missing data values. It is important to make any edits to the soil attributes before joining them with the spatial soils data.

Dual Hydrologic Classes

Soil hydrology is grouped by estimates of runoff potential based on infiltration rates. The groups range from A (high infiltration – low runoff potential) to D (very low infiltration – high runoff potential). Some groups will have dual classes (A/D, B/D, or C/D); the first letter is for drained areas while the second is for undrained areas. The natural condition for soils assigned dual classes is undrained; therefore OpenNSPECT automatically reads the D value. To simulate dryer conditions, a new column, Hydrologic Group – Dry, could be added to the soils database where the second value is deleted.

Missing Data Values

Frequently, some of the Hydrologic Group and K-factor (Kf) values will be missing. These are typically modified areas (urban land, pits, dumps) or those that have no soil profile (water, beaches, rock outcrops). When filling in missing values, use the description and name found in the Mapunit Name field; they are verbal descriptions of the soil types. Try to match up what seems appropriate for the missing data types. This is where your own expertise (or that of a colleague) comes in.

Data Acquisition and Preprocessing Steps

1. Acquire Elevation Data

Elevation data are the base from which the basin, watersheds, streams, slope, and other parameters are derived. National Elevation Dataset (NED) data are available from the U.S. Geological Survey (USGS) National Map Viewer. NED data are stored in 1 x 1 degree tiles. When downloading these data, users may receive more than one tile. If so, merge the tiles using the Merge Grids command. For many areas, NED data are available at resolutions of 1, 1/3, and 1/9 arc second, which equates to about 30-, 10-, and 3-meter resolution.

Overview of steps:

- Locate and acquire elevation data
- Review the elevation data
- Confirm that the data are projected

Locate and Acquire Elevation Data

1. Open *http://viewer.nationalmap.gov/viewer*.
    a. Use the **Zoom** tool to locate the study area.
    b. If you need help identifying the watershed extent, turn on the **Hydrography** layer in the Base Data Layers at left.
    c. At the top right of the webpage, click **Download Data**.
        i. In the “Download options” dialog, select **Click here to draw and download by bounding box**. Draw a box around the desired extent.
        ii. In the “USGS Available Data for download” dialog, select **Elevation > Next**.
        iii. Select **National Elevation Dataset (1 arc second) GridFloat** format > **Next**.
    d. In the Cart on the left of the page, click **Checkout**.
    e. Type your email when requested. Click **Place Order**.

2. Go to your email application.
    a. Open the email from the National Map Viewer. Click on the download link. (Your request may have more than one tile. Download all data listed.)
    b. Save the Zip file and unzip it to your data directory.

Review the Elevation Data

The extracted elevation archive will add a subdirectory to the data directory that will have a name based on the latitude and longitude of the selected area’s upper-left corner.

The directory should contain:

- A readme.pdf file covering data information and specifications
- A NED data dictionary, which includes metadata records
- A metadata shapefile
- A U.S. shapefile showing the 1 arc second grid locations
- The elevation data in floating point format

Confirm That the Data Are Projected

3. Start MapWindow GIS.
    a. **Add** the GridFloat elevation data.
    b. Review projection information in the Projection Properties at the lower left.

If you received more than one tile of elevation data, merge them together.

4. Select **Toolbox > Raster > Merge Grids**.
    a. In the Select Grids dialog box, click the + button and then navigate to and select the grids. Click **Ok**.
    b. Output File Format: **GeoTIFF (*.tif)**
    c. Output Path: **\\Your_data**
    d. Output Name: **Your_merged_elevation**
    e. **Finish**

2. Acquire Land Cover Data

Land cover is the basis of the OpenNSPECT tool's functionality. Land cover is used to estimate pollutant loads by applying coefficients for each pollutant to each land cover class. An excellent source for land cover is NOAA's Coastal Change Analysis Program (C-CAP) data. These are available at 30-meter resolution for the nation's coastal areas. Inland land cover data at 30-meter resolution is available from the National Land Cover Database (NLCD). OpenNSPECT contains default pollutant coefficients for both products.

Overview of steps:

- Locate and acquire land cover data
- Review the land cover data
- Confirm that the data are projected

Locate and Acquire Land Cover Data

1. Open *www.csc.noaa.gov/dataviewer/index.html*.
    a. In the Data Access Viewer, navigate to the study area.
        i. Under Enter Locations, either enter a location name or select **Draw Area**; then draw a box around the study area.
        ii. Under Refine Search, select **Data Type > Land Cover > Apply**.
        iii. Under Results, select the **C-CAP Regional Land Cover** (you may select multiple dates).
        iv. Click **+ Add to Cart**, and then **Checkout**.
    b. The default projection is geographic coordinates; click the radio button next to **Let me edit choices**.
    c. Select your target projection and datum.
    d. Add and confirm your email. Click **Next**.

2. Go to your email application.
    a. Open the email from Digital Coast Data Team. Click on the download link.
    b. Save the Zip file and unzip it to your data directory.

Review the Land Cover Data

The extracted land cover archive will add three files to your data directory:

- A metadata record in html format named for the mapping zone and product date (this is the metadata for the original land cover)
- A text file containing the parameters specified in the download process named with the job number, product date, and product (this is the source of projection information based on the download request)
- GeoTIFF land cover data named with the job number, product date, and product

Confirm That the Data Are Projected

3. Start a new MapWindow GIS Project.
    a. **Add** the GeoTIFF land cover data.
    b. Review projection information in the Projections Properties at the lower left.

3. Acquire Precipitation Data

Rainfall data provide the runoff component of OpenNSPECT. A good source for these data is the PRISM Climate Group at Oregon State University, which also provides access to a suite of climate maps that are available at a variety of spatial and temporal scales for the conterminous United States. These products were created using the Parameter – elevation Regressions on Independent Slopes Model (PRISM) climate-mapping system.

Overview of steps:

- Locate and acquire precipitation data
- Review the precipitation data
- Confirm that the data are projected
- If necessary, convert the data units

Locate and Acquire Precipitation Data

1. Open *www.prism.oregonstate.edu*.
    a. Select **30-Year Normals**.
        i. Spatial resolution needed: **800m**
        ii. Climate variable: **precipitation**
        iii. Temporal period: **annual values**
        iv. Download Data **(.bil)**
    b. **Save File > Ok**

2. Unzip the file to your data directory.

Review the Precipitation Data

The extracted precipitation archive will add two primary files to your data directory:

- A metadata file in XML format named for the product, time frame, resolution, and data format
- The precipitation data in Band Interleaved by Line format having the same naming convention as the metadata record

Confirm That the Data Are Projected

3. Start a new MapWindow GIS Project.
    a. **Add** the precipitation data.
    b. Review projection information in the Projections Properties at the lower left.

If Necessary, Convert the Grid Units

At the time of publication of this document, PRISM Average Annual Precipitation data were delivered as millimeters of accumulated rainfall. In this example, these data will be converted to inches.

4. Select **Toolbox > Raster > Change Grid Formats**.
    a. Select your precipitation data.
    b. Output File Format: **GeoTIFF (*.tif)**
    c. Output Data Type: **Single-Precision Floating (4 bytes)**
    d. Output Path: **\\Your_data**
    e. Multiply Values by Constant: **0.03937**
    f. **Finish**

4. Acquire Rainfall Factor (R-Factor) Data

The rainfall-runoff erosivity factor (R-Factor) quantifies the effects of raindrop impacts and reflects the amount and rate of runoff associated with the rain. The R-Factor is one of the parameters used by the Revised Universal Soil Loss Equation to estimate annual rates of erosion. When including erosion prediction in OpenNSPECT analysis, the R-Factor must be specified. This can be input as a raster file or a constant value. R-Factor raster data for the coterminous United States and six of the main Hawaiian Islands are available from the NOAA Coastal Services Center. For areas not covered by these data, a method to calculate R-Factor is described in the *U.S. Department of Agriculture (USDA) Handbook Number 703 (Wischmeier and Smith, 1978).

Overview of steps:

- Locate and acquire R-Factor for your study area
- Review R-Factor data
- Confirm that the data are projected and contain valid values
- If necessary, change the data format

Locate and Acquire R-Factor Data

1. Open *www.csc.noaa.gov/digitalcoast/tools/opennspect*.
   a. Click the Requirements tab.
   b. Select the desired R-Factor raster.

2. Unzip the file to your data directory.

Review the R-Factor Data

The extracted R-Factor archive will add a subdirectory to your data directory that will have a name based on the location.

The directory should contain:

- The R-Factor metadata records
- The R-Factor data in GeoTIFF format

Confirm That the Data Are Projected

3. Start a new MapWindow GIS Project.
   a. **Add** the R-Factor raster.
   b. Review projection information in the Projections Properties at the lower left.

*Wischmeier, W., and D. Smith. 1978. *Predicting Rainfall Erosion Losses: A Guide to Conservation Planning.* U.S. Department of Agriculture handbook No.703

5. Determine Study Area Boundary

If you need to define a boundary for your study area, a watershed generated from the elevation data works well. If you already have a predefined project boundary, skip to the next section.

Overview of steps:

- Create a polygon shapefile that covers the target watershed
- Clip the watershed from elevation data
- Generate watershed polygons
- Use the output basins to determine the watershed around the study area

Create a Polygon Shapefile That Covers the Target Watershed

1. Start a new MapWindow GIS Project.
    a. **Add** the elevation data.

2. Locate your target watershed on the elevation data.
    a. From the pull-down menu, select **Plugin-ins > Shapefile Editor**.
        i. In the Shapefile Editor toolbar, select **New**.
            1. Filename: **your_watershed_clip**
            2. Shapefile Type: **Polygon**
            3. **Ok**
        ii. In the Shapefile Editor toolbar, select **Add shapefile points**.
            1. Create a rectangle around the target watershed.

Clip the Watershed from Elevation Data

3. Select **Toolbox > Spatial Analyst > Raster Processing tools > Clip Grid with Polygon**.
    a. Select grid or image layer: **your_elevation.tif**
    b. Select shapefile layer: **your_watershed_clip.shp**
    c. Basename new raster files: **\\your_data\your_elevation_clip**
    d. **Start**

Generate Watershed Polygons

4. From the OpenNSPECT Toolbar, select **OpenNSPECT > Advanced Settings > Watershed Delineations**.
    a. In the Watershed Delineations dialog, select **Options > Create from a DEM**.
        i. Delineation Name: **Your_area-basin**
        ii. DEM Grid: **\\Your_data\your_elevation-null**
        iii. DEM Units: **meters**
        iv. Subwatershed Size: **large**
        v. **Ok**

Use the Output Basins to Determine the Watershed around the Study Area

Select all of those that intersect with your study area. Be sure to select all basins upstream.

5. Add layer:
   a. **C:\NSPECT\wsdelin\your_area-basin\basinpoly.shp**
   b. **C:\NSPECT\wsdelin\your_area-basin\stream.shp**

6. From the toolbars, use the **Select** tool to select those basins that flow through your study area.

7. Select **Toolbox > Vector Operations > Standard > Export Selection**.
   a. Shapefile **basinpoly**
   b. File to Save Results To: **\\Your_data\watersheds.shp**
   c. **Ok**

8. Select **Toolbox > Vector Operations > Standard > Buffer Shapes**.
   a. Vector Layer **watersheds**
   b. Buffer distance **45 Meters**
   c. File to save Results To: **\\Your_data\your_study_area.shp**
   d. **Ok**

6. Clip Raster Data to Study Area

To work in OpenNSPECT, the input raster data need to be in the same projection and clipped to the same boundary. To accomplish this, use the Clip and Project New Data tool. The tool will reproject all files to the target projection, snap raster cells and layers, and clip to the project boundary file. The output data will be added to a new OpenNSPECT data preparation folder, \\Your_data\ON_DataPrep.

1. Start a new MapWindow GIS Project.

2. Select **OpenNSPECT > Advanced Settings > Clip and Project New Data**.
   Final Area of Interest and Projection:
   a. AOI Shapefile **\\Your_data\your_study_area.shp**
   b. Final Cell Size **30**
   Initial Data:
   c. Elevation Raster **\\Your_data\your_elevation.tif**
   d. Landcover Raster **\\Your_data\your_landcover.tif**
   e. Precipitation Raster **\\Your_data\your_precipitation.bil**
   f. R-Factor Raster **\\Your_data\your_R-Factor.tif**
   g. **Ok**

7. Acquire and Process Soils Data

Soils data are used to estimate sediment loads. Two soil parameters are needed: the hydrologic soils group, which is a measure of how permeable the soils are; and the K-factor, which is a measure of how erodible the soils are. This information can be obtained from the Soil Survey Geographic (SSURGO) database, an archive of county-level soil data for most of the United States, maintained by the USDA Natural Resource Conservation Service. This is an excellent first (and generally last) place to look for county-level soils data.

Overview of steps:

- Locate and acquire soils data
- Review the soils data
- Extract relevant attributes from the database
- Create a soil attribute spreadsheet and modify or fill in any values necessary
- If your study area contains more than one county, merge the shapefiles
- Join soils attributes to the spatial data
- Export the joined spatial database to a new shapefile
- Reproject and clip the soils layer to your watershed boundary

Locate and Acquire Soils Data

1. Open *http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx*.
   a. Click on the **Download Soils Data** tab.
   b. Select **Soil Survey Area (SSURGO)**.
      i. Under Options, select your state and county.
      ii. Under Soil Survey Area (SSURGO) Download Links, select the link for Tabular and Spatial Data for the county.
      iii. Unzip the data to your data directory.
   c. If your watershed extends into more than one county, repeat the above steps to acquire all necessary soils data.

Review the Soils Data

The extracted soil archive will add a subdirectory to your data directory that will have a name based on your state and survey area: wss_SSA_XXZZZ_soilb_XX_YYYY, where XX is the two-letter state abbreviation, ZZZ is the survey area number (which may be more or less than three digits), and YYYY is soil survey date.

The directory should contain these elements:

- A readme.txt file
- A subdirectory named Spatial, containing shapefiles
- A subdirectory named Tabular, containing data tables
- A database template, soildb_XX_YYYY.mdb
- Two metadata files in text and xml formats: soil_metadata_XXZZZ.txt and soil_metadata_XXZZZ.xml

If your study area contains more than one county, repeat steps 2-6 below and merge the shapefiles using the Merge Shapefiles command.

Extract Relevant Attributes from the Database

2. Double-click **soildb_XX_YYYY.mdb** to open it.
    a. If prompted to convert the data base, click **Ok**.
    b. If prompted to disable any macros, click **Disable**.
    c. If prompted to enable content, **Enable Content**.
    d. In the SSURGO Import dialog box, enter the complete path for the tabular directory that the form Soil Reports will open.
        i. Click **Select All** for the Map Units.
        ii. In the **Report Name** pull-down, select **RUSLE2 Related Attributes**.
        iii. Click **Generate Report**.
        A printable report will be generated and will display in another window. Dismiss any Page Setup dialog that pops up. This report has the information required but is not formatted in an easily usable way.
        iv. **Exit** the report.
    e. Notice that the header on the left panel of the database window is actually a pull-down menu.
        i. Open it and select **Queries**.
        ii. Scroll down and double-click on **Report – RUSLE2 Related Attributes**.

Create a Soil Attribute Spreadsheet and Modify or Fill In Any Values Necessary

You will now have an open table with a number of columns. The ones you need are Mapunit Symbol, Hydrologic Group, Kf, and Local Phase. You can now import the information from the Microsoft Access database into your shapefile's attribute table.

3. Open a spreadsheet program.
    a. In Microsoft Access, select and **Copy** the entire query table.
    b. In the spreadsheet, select **Paste Special > Text**.
    c. Change the worksheet name to RUSLE_Info.
    d. Make any necessary edits to the spreadsheet (modify Hydrologic Group values, fill in missing Hydrologic Group and Kf values).
    e. Save the spreadsheet to your data directory: **Your_area_RUSLE_Info.xls**.
    f. **Close** the spreadsheet.

Join Soils Attributes to the Spatial Data

4. Start a new MapWindow GIS Project.
    a. **Add** \\spatial\soilmu_a_XXZZZ.shp.
    b. In the MapWindow Legend Layers, right-click **soilmu_a_XXZZZ.shp** and select **Attribute Table Editor** to bring up the attribute table.
        i. Select **Get All** to load all the shapes.
        ii. Click **Join External Datasource** (in version 4.8.8, it is the rightmost icon).
        An External data window will open.
            1. Click **Add**.
            2. Change the default file extension to **Excel workbooks (*.xls, *.xlsx)**.
            3. Navigate to and select **Your_area_RUSLE_Info.xls**.
            4. The Joining file dialog box will open; link MUSYM to Mapunit Symbol:
                a. RUSLE Info
                b. Click **Get Columns**

c. Current **MUSYM**
d. External **Mapunit Symbol**
e. **Join**
f. **Ok**
g. **Close**

Export the Joined Spatial Database to a New Shapefile

5. In the MapWindow toolbars, click the **Select** button and draw a box around your entire watershed.

6. Select **Toolbox > Vector Options > Export Selection**.
   a. Shapefile **soilmu_a_XXZZZ**
   b. File to Save Results to: **\\Your_data\your_soils.shp**
   c. **Ok**

If Study Area Contains More Than One County, Repeat Steps 2-6 and Merge Shapefiles

7. Select **Toolbox > Merge Shapefiles**.
   a. Vector Layer 1 **Your_soils_county1.shp**
   b. Vector Layer 2 **Your_soils_county2.shp**
   c. File to Save Results to: **\\Your_data\merged_soils.shp**

Reproject and Clip the Soils Layer to the Watershed Boundary

8. Select **Toolbox > Projections > Reproject Shapefile**.
   a. Select your target projection.
   b. Click the + button to select the input shapefile: **\\Your_data\your_soils.shp**
   c. **Reproject**

   The output shapefile will have the new projection information appended to the name.

9. Select **Toolbox > Vector Options > Overlays > Clipping**.
   a. Subject shapefile **\\Your_data\your_soils_proj.shp**
   b. Clipping shapefile **\\Your_data \your_study_area.shp**
   c. File to Save Results to: **\\ON_Data_Prep\your_soils.shp**
   d. **Ok**

8. Generate OpenNSPECT Parameters from the Input Data

Derivative information from some of the input layers is required to run OpenNSPECT. These include watersheds and flow dynamics from the elevation data, precipitation scenarios from the rainfall data, and hydrologic group and erodibility factor from the soils data.

Use the OpenNSPECT Advanced Settings to process these layers.

Watershed Delineation

1. From the OpenNSPECT Toolbar, select **OpenNSPECT > Advanced Settings > Watershed Delineations**.
   a. In the Watershed Delineations dialog box, select **Options > Create from DEM**.
      i. Delineation Name: **your_watershed**
      ii. DEM Grid: **\\ON_Data_Prep\your_elevation**
      iii. DEM Units: **meters**
      iv. Subwatershed Size: **small**
      v. **Ok**

Precipitation Scenarios

2. From the OpenNSPECT Toolbar, select **OpenNSPECT > Advanced Settings > Precipitation Scenarios**.
   a. In the Precipitation Scenarios dialog box, select **Options > New**.
      i. Scenario Name: **Your precip**
      ii. Description: **Your avg annual precipitation**
      iii. Precipitation Grid: **\\ON_Data_Prep\your_precip**
      iv. Grid Units: **meters**
      v. Precipitation Units: **inches**
      vi. Time Period: **Annual**
      vii. Raining Days: **###** (the average annual number of raining days for your study area)
      viii. Type: **Type I**
      ix. **Ok**

Soils

3. From the OpenNSPECT Toolbar, select **OpenNSPECT > Advanced Settings > Soils**.
   a. In the Soils dialog box, select **Options > New**.
      i. Name: **Your_soils**
      ii. DEM GRID: **\\ON_Data_Prep\your_elevation**
      iii. Soils Data Set: **\\ON_Data_Prep\your_soils.shp**
      iv. Hydrologic Soil Group Attribute: **hydgrp**
      v. K-Factor Attribute: **kf**
      vi. MUSLE Equation for sediment yield:
         1. a= 95
         2. b= 0.56
      vii. **Ok**

Run a Test OpenNSPECT Analysis

This exercise will confirm that all input data have been processed properly and generate output pollutant and erosion estimates.

1. Start a new MapWindow GIS Project:
   Add **\\ON_Data_Prep\your_landcover.tif**
   ON_Data_Prep\your_soils.shp
   \\ON_Data_Prep\your_dem.tif
   \\ON_Data_Prep\your_precip.tif

Initiate OpenNSPECT Analysis.

2. From the **OpenNSPECT Toolbar, OpenNSPECT > Run Analysis**.

3. In the OpenNSPECT project dialog box, enter the following parameters:
   a. Name: **Your analysis**
   b. Land Cover Grid: **your_landcover**
   c. Land Cover Type: **c-cap**
   d. Soils Definition: **your_Soils**
   e. Precipitation Scenario: **your_precip**
   f. Watershed Delineation: **your_ws**
   g. Working Directory: **C:\NSPECT\workspace**
   h. Pollutants tab:
      i. Check Apply box: **Nitrogen**
      ii. Coefficient Set: **Nit1**
      iii. Which Coefficient: **Type 1**
   i. Erosion tab:
      i. Check box **Calculate Erosion for Annual Type Precipitation Scenario**
      ii. Rainfall Factor: Use Constant Value: or select your_R-Factor raster
      iii. Click **Run** and **Save** with the default name when prompted.

If all of your data were processed accurately, you will see results for

- Accumulated Runoff (L)
- Accumulated Nitrogen (kg)
- Nitrogen Conc. (mg/L)
- Accumulated Sediment (kg)