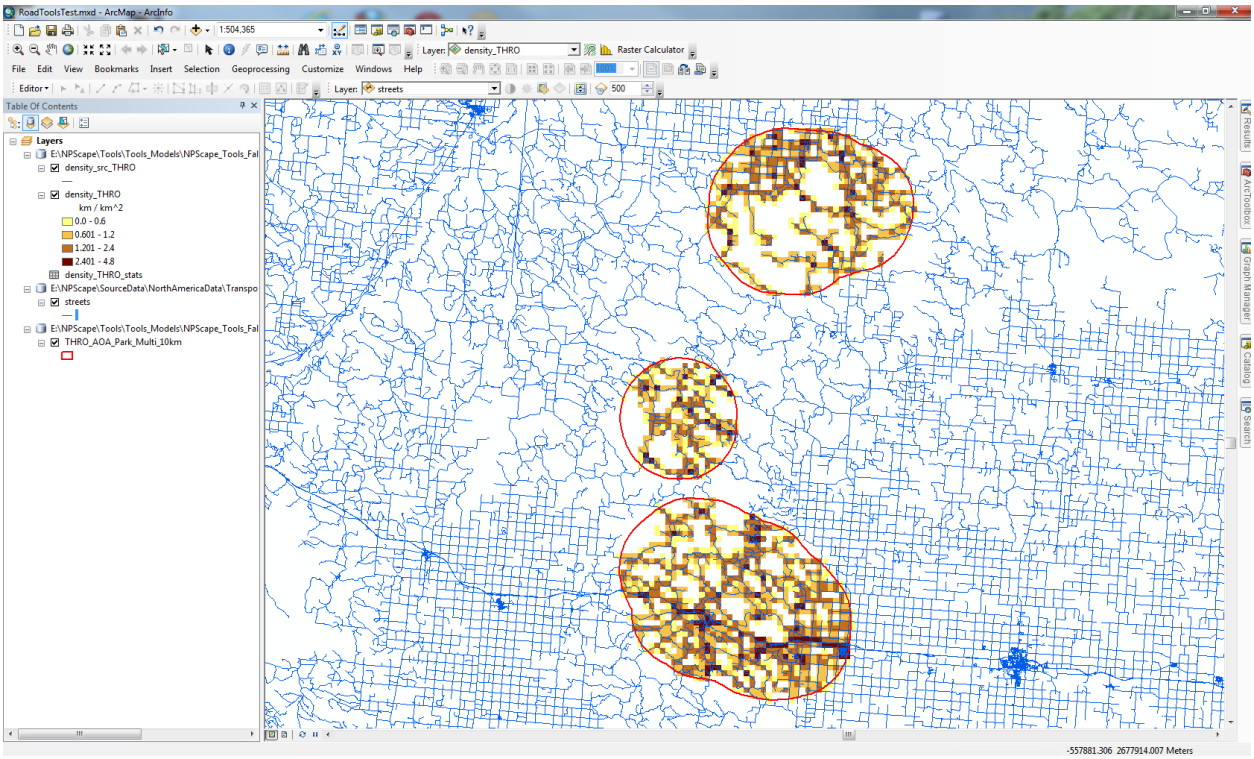
National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

NOTE: There may be revised processes and documentation available.

Check the NPScape methods webpage
(http://science.nature.nps.gov/im/monitor/npscape/methods.cfm)
for the most current version.

NPScape Standard Operating Procedure: Roads Measure – Road Density, Distance from Roads, and Area without Roads



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Version History		
Version	Update Date	Changes
20130214	20130214	Revised to better describe how users can input local roads data, other than ESRI Streetmap
20130315	20130315	Note added regarding an issue in Geoprocessing Options between ArcMap 10.0 and 10.1 that could cause a script to fail in 10.1
20131213	20131213	Tool optimized for use in 10.1, and tested for use with 10.2
20150415	20150415	Successfully tested for use with 10.3

Overview

NPScape is a landscape dynamics monitoring project that provides landscape-level data, tools, and evaluations for natural resource management, planning, and interpretation (NPS 2013). This standard operating procedure (SOP) provides guidance on how to process data for the roads metrics used in NPScape. Source data are assumed to be ESRI Streetmap streets vectors, but other road input data may be used. Three metrics are calculated for roads: road density (prefixed with 'RDD'), distance from roads (prefixed with 'RDF'), and areas without roads (prefixed with 'RAW'). Download the tool(s) and a copy of this SOP here http://science.nature.nps.gov/im/monitor/npscape/methods.cfm.

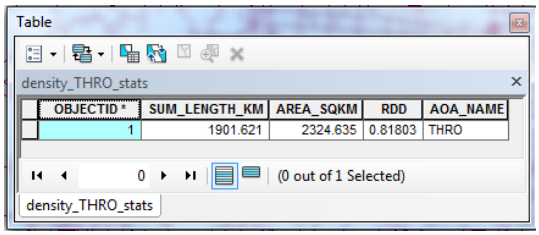
The purpose of this SOP is threefold. First, because these directions were followed in the processing of the NPS datasets, it provides detailed documentation on the methodology used by NPScape to calculate metrics for the Roads measure. Second, this SOP provides any user with the ability to replicate the creation of these data for custom areas of analysis. Finally, if an I&M park or network has a need to analyze roads data other than ESRI Streetmap, this SOP provides a processing template for recalculating focal metrics associated with the Roads measure.

By default, all road features are used when calculating density, distance, and areas without roads. If metrics for a subset of road type or types is needed, use the selection tools in ArcMap to select specific road segments before running the tools. See the Interpretation Tips section for details on how road density and distance are calculated for an area of analysis.

For ESRI Streetmap road features, the FCC (Feature Class Code) values present in the source data are used to identify road types. Highways are defined as interstates (FCC: A10-A19) or major roads (FCC: A20-A38, excluding ferry routes). All roads include all road features from the source data regardless of FCC value (excluding ferry routes). Weighted roads are produced by multiplying the lengths of interstate roads by a factor of 5 and remaining major roads by a factor of 3. In Alaska, non-vehicular roads (FCC: A70-A79) are weighted by a factor of 0.25. Ferry routes are features with FCC values of A65, A66, A68, or A69. Additionally, in Alaska, ferry routes are features with FCC values like A2* and NAME values of 'Alaska Maritime*'. Note, ferry route features are excluded prior to processing road density and distance.

The NPScape road metrics are intended to assist with determining the direct and indirect impact of roads on habitat, landscape structure, fragmentation, species composition, and hydrologic processes. Monitoring questions related to roads include (Monahan et al. 2012):

- What is the density of roads (km/km^2) in parks and adjacent areas?
- How do these density values compare to densities thought to affect wildlife or other resources?
- How far are park resources from the nearest roads?
- What percent of the park and surrounding lands are roadless?
- How do the sizes of roadless areas in the parks compare to the sizes of roadless areas in the local landscape?



Using an ArcGIS™ toolbox, road density processing steps include clipping the input roads features to both the area or analysis (AOA) and a buffered AOA, calculating the overall road density for the AOA and generating a km/km^2 density raster by calculating a km^2 fishnet over the entire AOA. Road distance processing uses the buffered clipped road features to create a Euclidean distance output. Finally, the Euclidean distance output is used to generate area without roads polygons.

Any AOA can be used as long as its spatial reference matches that of the tool input data.

The tools are designed to be generalized, which may require additional pre-processing steps and/or feature selections if using an input source other than the ESRI Streetmap road features. See the running the tool sections and Appendix 3 for details. The SOP was tested with ESRI Streetmap road features and OpenStreetMap-derived road features.

Software Requirements

ArcGIS software is required to generate the metric outputs. The data sources and tools used are assumed to be in ESRI ArcGIS™ format, version 10.1 Service Pack 1 or higher.

Data Requirements

ESRI Data and Maps - U.S. and Canada Detailed Streets, TeleAtlas 2005 (ESRI 2010) or alternative

See the Frequently Asked Questions section for tool input acquisition options.

Area of Analysis polygon

AOA polygons for boundaries and 3 km and 30 km buffers of parks, CEC ecoregions, FWS LCC polygons, and upstream watersheds (for selected parks) are available as NPScape datasets:
http://science.nature.nps.gov/im/monitor/npscape/methods.cfm

Alternatively, user-defined AOA polygons can be used if they conform to the input spatial reference.

Input data spatial reference

For CONUS areas, the NPScape project uses USA Contiguous Albers Equal Area Conic USGS as its standard spatial reference. A local (i.e. custom, non-NPScape sourced) area of analysis polygon may be used if its spatial reference matches the NPScape-provided tool input raster or vector data. In this scenario, re-project your local AOA data (if necessary) and run repair geometry on it before running the tool(s). See the Frequently Asked Questions section for more details on re-projecting tool outputs or tool inputs.

Input Data Pre-Processing

Determine AOA polygon

If using an NPScape-sourced AOA, download the appropriate AOA geodatabase from the link in the Data Requirements section.

Re-project user-defined input datasets (if needed)

All user-defined, custom, non-NPScape sourced tool inputs (e.g. AOA polygon) must be in the USA Contiguous Albers Equal Area Conic USGS spatial reference if used with NPScape-sourced tool inputs. Otherwise, use an equal area projection and match the AOA spatial reference to the input road features dataset.

1. Open ArcCatalog or ArcMap. Click the search button and search for 'Project'. Open the Project tool and re-project your data to USA Contiguous Albers Equal Area Conic USGS.
2. Search for 'Repair Geometry' and run that tool on your re-projected dataset.
3. See the Frequently Asked Questions section for more details.

Acquire tool input dataset(s)

Download the road features to be used. The ESRI streets geodatabase is included as an ESRI data product.

Define Weighting of Road Types, Exclusions, and Buffer Distance for Distance from Roads Calculations

If the weighted density outputs are generated, a weighting field and SQL query must be specified. By default, for weighted road density calculations using the ESRI streets feature class, NPScape processing scripts weight interstate roads with a multiplier of 5. Since most interstate road features are composed of two polylines, interstates typically receive a combined weight of 10. Major (non-interstate roads) are weighted by 3. For Alaska, non-vehicular roads are weighted as 0.25. All other road types (e.g., local paved streets, unpaved county roads and Forest Service roads) are given a weight of 1. For non-ESRI streets input, the specified weighting field and query weights roads with a multiplier of 5.

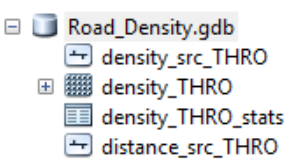
Certain road types are excluded from NPScape road metrics based on ESRI streets input: FCC = A20 features that are ferry routes or maritime highways. If exclusion is needed for non-ESRI streets input, run a selection operation on the features to be retained prior to running the road density tool.

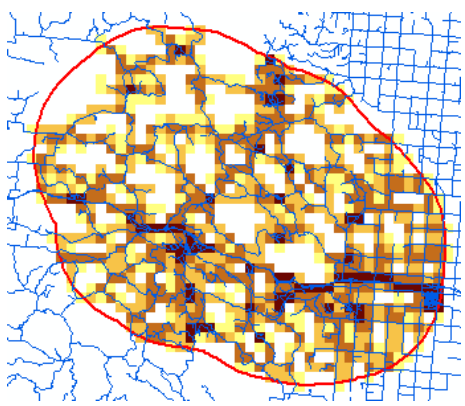
To minimize artifacts in distance from road outputs, road features are buffered by a pre-set distance of 10 kilometers outside of the area of analysis, so values on the edges of the areas of analysis reflect roads up to 10 km outside the AOA.

Run Road Density tool

This tool generates a file geodatabase containing a road density (km/km^2) raster, two feature classes: density roads (clipped to AOA) and distance roads (clipped to 10 km buffer of AOA). Also, a summary statistics table of total road density for the AOA is generated.

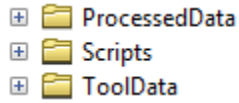
Example tool outputs:





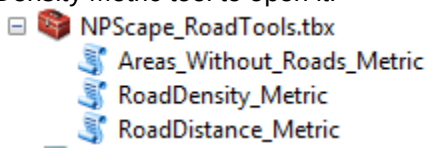
Add toolbox to ArcMap

1. Check Geoprocessing Options settings: Geoprocessing → Geoprocessing Options → 'Overwrite the Outputs of Geoprocessing Operations' should be checked. This addresses an issue in ArcGIS 10.1 Service Pack 1 when using feature layers.
2. Extract the tools zip file downloaded from the methods link in the Overview section above. The following folder structure will be created:



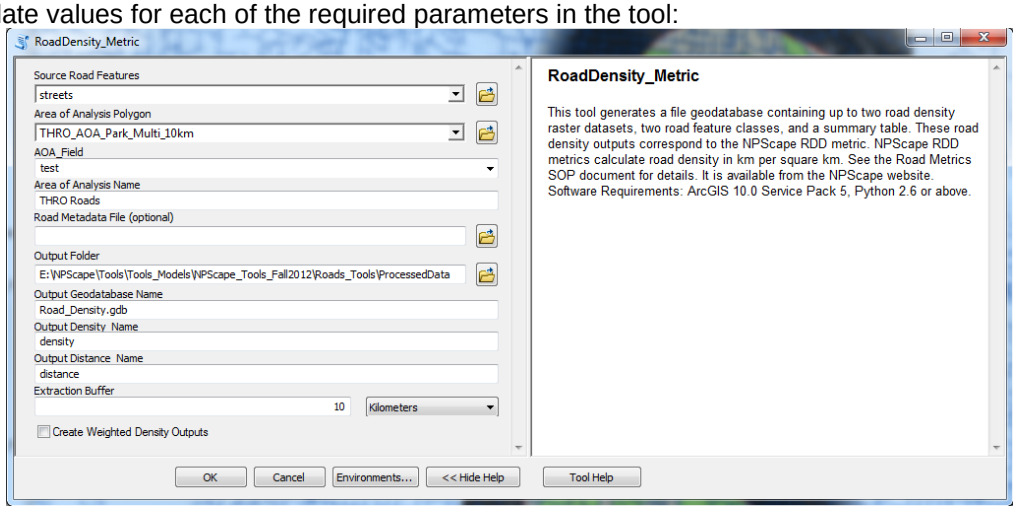
ProcessedData contains ArcMap layer files and is the default tool output folder. Scripts contains the Python code used by the NPScape_RoadTools.tbx toolbox.

3. Open ArcMap use the Catalog window to navigate to the folder where the tools were extracted. Open the NPScape_RoadTools toolbox.
4. Double-click on the Road Density Metric tool to open it.



Run the Road Density Tool

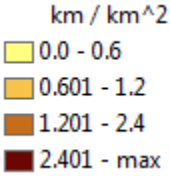
1. Add input data to the map:
   - Tool input: road features
   - Polygon feature class for AOA (single or multi-part)
2. If metrics for a subset of road type or types is needed (e.g. major roads), use the selection tools in ArcMap to select specific road segments before running the tool.
3. Populate values for each of the required parameters in the tool:



Source Road Features: Tool input road features
Area of Analysis Polygon: feature class used as area of analysis
AOA Field: Text format attribute from Area of Analysis Polygon. Used to label output feature classes and tables for multi-feature AOAs.
Area of Analysis Name: Area of analysis name. For example, ROMO or Upper Lost Creek Watershed. This value is copied to all output rasters, feature classes, and summary tables.
Road Metadata File (optional): XML format (FGDC) metadata for output files
Output Folder: defaults to ProcessedData subfolder. You must have write permission to this folder.
Output Geodatabase Name: Name for output geodatabase. Must end in *.gdb.
Note: if the geodatabase already exists, feature classes and the table will be overwritten
Output Density Name: prefix for density outputs
Output Distance Name: prefix for distance outputs
Extraction Buffer: Buffer distance in kilometers. Used to extract road features for distance calculations.
Create Weighted Density Outputs: Toggle to create weighted density raster and vector outputs.
Weighting Field: Text format field from Source Road Features feature layer. Used to weight road features to produce weighted density raster. Defaults to ESRI streets feature class 'FCC' attribute. Required if Create Weighted Density Outputs parameter is selected.
Weighting Query: SQL query used to select source road features to be weighted. Defaults to

"FCC" LIKE 'A1%' in ESRI streets feature class. Required if Create Weighted Density Outputs parameter is selected.

4. Depending on the extent of the AOA feature class, the tool may take several minutes to run. Processing status will display in ArcMap, either as a popup or as a message in the geoprocessing background bar. The full tool summary is found in the ArcMap → Geoprocessing → Results popup, including error messages.
5. The road density raster, clipped road feature class, and statistics table will be added automatically to the map. If the Create Weighted Density Outputs option was checked, the weighted output raster, clipped weighted road feature class, and statistics table will be added as well. If single-part AOA polygons were used, only the raster, feature class, and statistics tables for the last feature will be added to the map. Other output rasters and tables can be added manually and the rasters symbolized with *.lyr files in the ProcessedData subfolder.

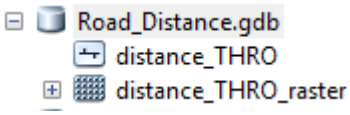


6. See tables in the Interpretation Tips section for a description of attributes in the output raster, feature classes and statistics table.
7. Running the tool again: open Geoprocessing → Results. Double-click on the Road Density Metrics tool name to open the tool dialog. Change parameters as needed. Change the output geodatabase name if you don't want your original output over-written. Or, rename your output feature classes and they will be added to your existing geodatabase, without overwriting your previous run(s) of the tool.

Run Road Distance tool

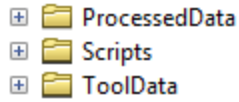
This tool generates a file geodatabase containing a road distance (meters) raster and a feature classes: distance roads (clipped to 10 km buffer of AOA).

Example tool outputs:



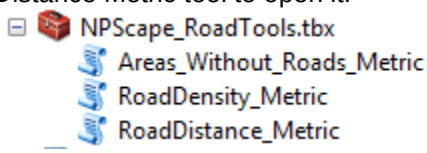
Add toolbox to ArcMap

1. Check Geoprocessing Options settings: Geoprocessing → Geoprocessing Options → 'Overwrite the Outputs of Geoprocessing Operations' should be checked. This addresses an issue in ArcGIS 10.1 Service Pack 1 when using feature layers.
2. Extract the tools zip file downloaded from the methods link in the Overview section above. The following folder structure will be created:



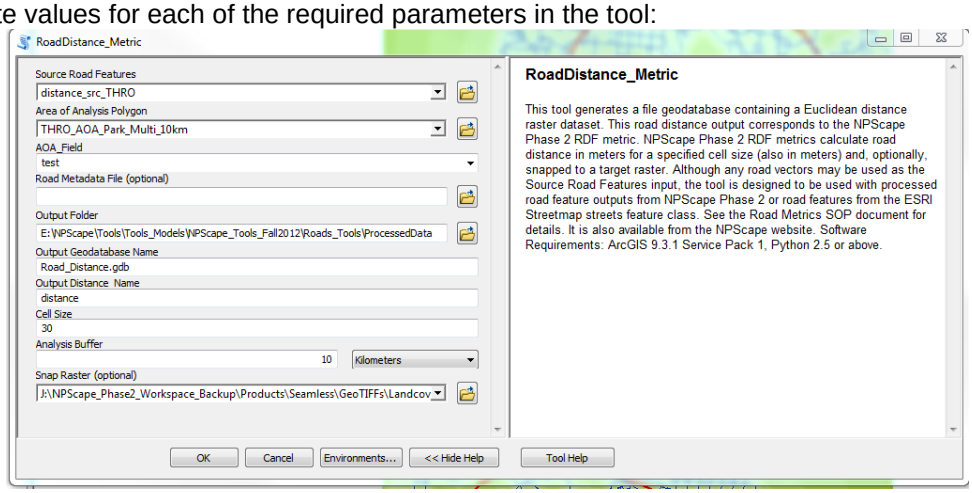
ProcessedData contains ArcMap layer files and is the default tool output folder. Scripts contains the Python code used by the NPScape_RoadTools.tbx toolbox.

3. Open ArcMap use the Catalog window to navigate to the folder where the tools were extracted. Open the NPScape_RoadTools toolbox.
4. Double-click on the Road Distance Metric tool to open it.



Run the Road Distance Tool

8. Add input data to the map:
   - Tool input: distance road features produced from Road Density tool (*Note: if single-part, multifeature AOA was used for road density, the Road Distance tool will need to be run on each distance feature output*).
   - Polygon feature class for AOA (single or multi-part)
9. Populate values for each of the required parameters in the tool:



Source Road Features: Distance road features produced by Road Density tool (***if you have a single-part AOA feature, you will have to run this tool for each density distance vector feature class you have**)**

Area of Analysis Polygon: feature class used as area of analysis

AOA Field: Text format attribute from Area of Analysis Polygon. Used to label output feature classes and tables for multi-feature AOAs. Be sure each part (if a singlepart feature) has a unique name in this field or each part, when run, will overwrite the previous.

Road Metadata File (optional): XML format (FGDC) metadata for output files

Output Folder: defaults to ProcessedData subfolder. You must have write permission to this folder.

Output Geodatabase Name: Name for output geodatabase. Must end in *.gdb.

Note: if the geodatabase already exists, the raster and feature class will be overwritten

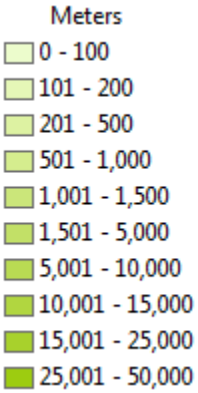
Output Distance Name: prefix for distance outputs

Cell Size: pixel size in meters for output Euclidean distance raster

Analysis Buffer: Buffer distance in kilometers. Used to buffer source road features for distance calculations (minimizes edge effects)

Snap Raster (optional): Raster to which output Euclidean distance raster is snapped (e.g. land cover raster). Cell size should match the cell size parameter.

10. Depending on the extent of the AOA feature class, the tool may take several minutes to run. Processing status will display in ArcMap, either as a popup or as a message in the geoprocessing background bar. The full tool summary is found in the ArcMap → Geoprocessing → Results popup, including error messages.
    a. If you have a single-part AOA feature, this tool will only run on the FIRST in the feature. You will have to manually select each part in the attribute table before you run the tool to create Euclidean distance rasters for each part. By default, it will only run one part at a time.
11. The road Euclidean distance raster and the input road distance feature class will be added automatically to the map. If single-part AOA polygons were used, only the raster and feature class for the last AOA feature will be added to the map. Other output rasters and feature classes can be added manually and the rasters symbolized with Distance from All Roads.lyr file in the ProcessedData subfolder.

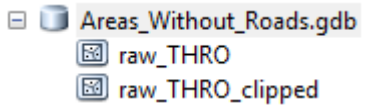


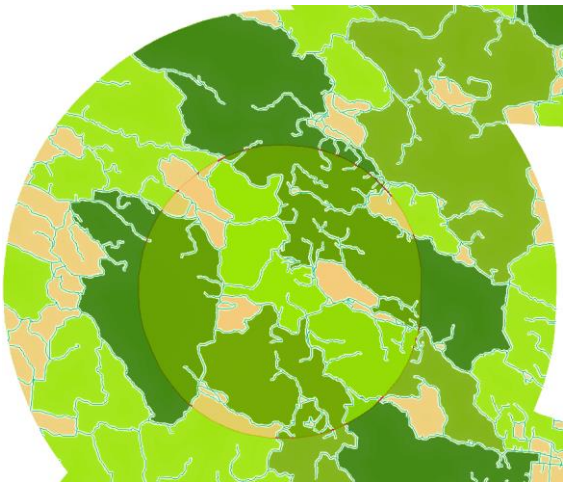
12. The output Euclidean distance raster is a continuous floating point raster that extends to the buffered extent of the input road distance features. See the Interpretation Tips section for more information.
13. Running the tool again: open Geoprocessing → Results. Double-click on the Road Distance Metrics tool name to open the tool dialog. Change parameters as needed. Change the output geodatabase name if you don't want your original output over-written. Or, rename your output feature classes and they will be added to your existing geodatabase, without overwriting your previous run(s) of the tool.

Run Area without Roads tool

This tool generates a file geodatabase containing two feature classes: areas without roads clipped to the AOA and areas without roads extending to the extent of the input Euclidean distance raster.

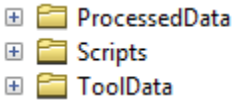
Example tool outputs:





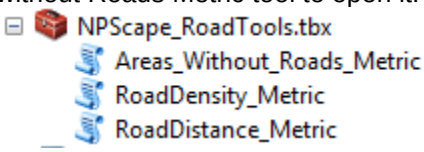
Add toolbox to ArcMap

5. Check Geoprocessing Options settings: Geoprocessing → Geoprocessing Options → 'Overwrite the Outputs of Geoprocessing Operations' should be checked. This addresses an issue in ArcGIS 10.1 Service Pack 1 when using feature layers.
6. Extract the tools zip file downloaded from the methods link in the Overview section above. The following folder structure will be created:



ProcessedData contains ArcMap layer files and is the default tool output folder. Scripts contains the Python code used by the NPScape_RoadTools.tbx toolbox.

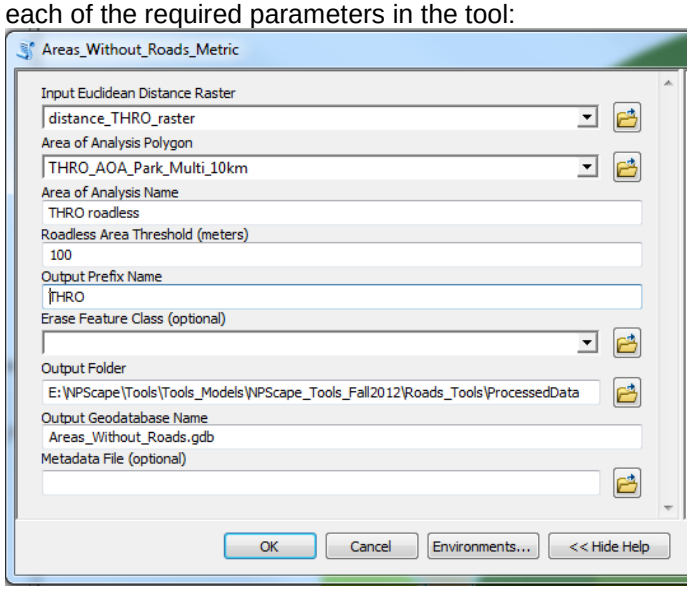
7. Open ArcMap use the Catalog window to navigate to the folder where the tools were extracted. Open the NPScape_RoadTools toolbox.
8. Double-click on the Areas without Roads Metric tool to open it.



Run the Areas without Roads Tool

14. Add input data to the map:
    - Tool input: Euclidean distance raster produced from Road Distance tool
    - Polygon feature class for AOA (single or multi-part)
    - Optional polygon feature class used to erase areas from output feature classes (e.g. hydrology or protected areas)

15. Populate values for each of the required parameters in the tool:



Input Euclidean Distance Raster: Distance raster produced by Road Distance tool (******if you have a single-part AOA feature, you will have to run this tool for each Euclidean distance raster you have******)
Area of Analysis Polygon: feature class used as area of analysis
Area of Analysis Name: Area of analysis name. For example, ROMO or Upper Lost Creek Watershed. This value is copied to all feature classes.
Roadless Area Threshold (meters): distance from road features used to generate areas without roads patches
Output Prefix Name: prefix for naming output feature classes
Erase Feature Class (optional): polygon feature class used to erase areas from output feature classes (e.g. hydrology or protected areas)
Output Folder: defaults to ProcessedData subfolder. You must have write permission to this folder.
Output Geodatabase Name: Name for output geodatabase. Must end in *.gdb.
Note: if the geodatabase already exists, the raster and feature class will be overwritten
Metadata File (optional): XML format (FGDC) metadata for output files

16. Depending on the extent and cell size of the input raster, the tool may take several minutes to run. Processing status will display in ArcMap, either as a popup or as a message in the geoprocessing background bar. The full tool summary is found in the ArcMap → Geoprocessing → Results popup, including error messages.
    a. If your AOA feature is single-part, make sure that you rename each area without roads output geodatabase to correspond to the correct part of the AOA feature or your data will be written over each time you run the tool.
17. The output feature classes will be added automatically to the map. The patch areas will vary between the clipped feature classes. The unclipped feature class patches will extend up to the extent of the input Euclidean distance raster. See the Interpretation Tips section for more information.

18. Running the tool again: open Geoprocessing → Results. Double-click on the Areas wihout Roads Metrics tool name to open the tool dialog. Change parameters as needed. Change the output geodatabase name if you don't want your original output over-written. Or, rename your output feature classes and they will be added to your existing geodatabase, without overwriting your previous run(s) of the tool.

Quality Control

Verify density dataset outputs

1. Verify the expected density raster is created. Verify the density and distance source (OutputDensityName_src_*) feature classes are created and that they contain AOA_NAME and CALC_LENGTH_KM fields
2. If a multi-feature singlepart AOA polygon was used, there will be outputs for each AOA feature, named with the value of the AOA Field attribute. However, only outputs for the last feature processed will be added to the map automatically.
3. Verify that density raster cells extend across the AOA feature edges.

Verify density statistics output

1. Open the density statistics table and check that the SUM_LENGTH_KM, AREA_SQKM, RDD, and AOA_NAME fields are populated. Check that the SUM_LENGTH_KM value equals the sum of the CALC_LENGTH_KM field from the output density feature class (right-click CALC_LENGTH_KM and choose 'Statistics').
2. By default, only the density statistics table for the last feature is added to the map. Add the remaining statistics tables, if present and verify attributes are populated.
3. Select one record from each statistics table and double-check the PCT_AREA column values by re-calculating them by hand:

   RDD = (SUM_LENGTH_KM / AOA_FEATURE_AREA_SQKM)

Verify distance raster output

1. Verify the expected Euclidean distance raster is created. If a snap raster was used, use the Effects → Swipe tool to help verify the snap was successful.
2. If a multi-feature singlepart AOA polygon was used, there will be raster outputs for each AOA feature, named with the value of the AOA Field attribute. However, only outputs for the last feature processed will be added to the map automatically. Add remaining output rasters and verify snapping, if used.

Verify area without roads dataset outputs

1. Verify AREA_SQKM and AOA_Name values exist in the attribute tables.

Interpretation Tips

Road density output feature class and statistics table attributes:

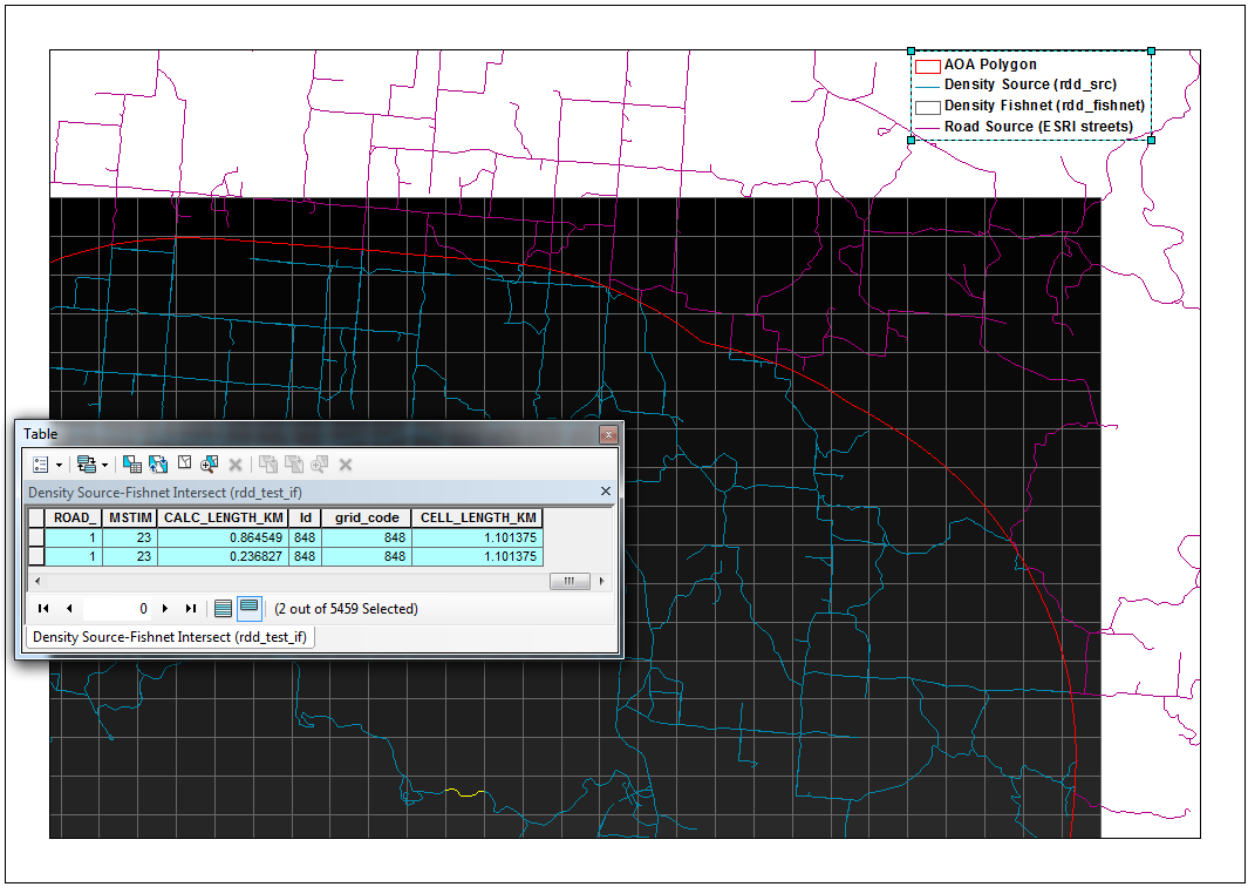
Density feature class attributes:

CALC_LENGTH_KM	Segment length for input road features, in km

Road density statistics table attributes:

SUM_LENGTH_KM	Sum of the calculated road segment lengths, in km
AOA_FEATURE_AREA_SQKM	Total area of the AOA in km^2, calculated from polygon feature
RDD	Road density for AOA in km/km^2, SUM_LENGTH_KM / AOA_FEATURE_AREA_SQKM
AOA_NAME	AOA name from AOA Identifier tool parameter concatenated with AOA Field value

Logic for generating road density:



A temporary raster is used to generate a 1km fishnet (Density Fishnet) over the AOA extent. This fishnet is intersected with the input roads features and road segment lengths (in km) are calculated for each fishnet polygon. The road segment lengths are summed for each polygon using the grid_code attribute as a case field. These sums are used to generate the Road Density raster in km/km^2. The selected records shown are intersected fishnet/road features for the fishnet polygon ID 848 with yellow road segments shown below the table. This polygon contains two road segments, totaling 1.01375 km. Since, the fishnet polygons are 1km square, in the resulting Road Density raster, the cell value is 1.01375 km/km$^{2.}$

Distance from roads:

The output Euclidean distance raster is a continuous floating point raster that extends to the buffered extent of the input road distance features. Therefore, distance is calculated outside the AOA polygon. This allows maximum flexibility when interpreting distance across the AOA boundary.

Area without roads output feature class attributes:

Area without roads feature class attributes:

AREA_SQKM	Area of patch, in km^2
AOA_NAME	AOA name from AOA Identifier tool parameter

Patch sizes between the clipped and unclipped outputs will vary since the unclipped features extend beyond the AOA boundary. Producing both feature classes allows for patch area comparisons across the AOA bound. An intersect operation may be run to select patches that cross the AOA bound. These intersecting patches may be useful for various analyses.

Frequently Asked Questions

Can/should I use a different spatial reference?

Any NPScape spatial output can be re-projected to a 'final' local spatial reference. For vector outputs, Repair Geometry should be run after re-projection. This approach should be noted in explanatory or interpretive documentation to avoid misleading the user; re-projection of an output dataset will have no effect on area attributes in the summary table generated by the NPScape script.

All NPScape tools generate area calculations from input data. If tool input data must be re-projected prior to running the tools, care should be taken to use a local spatial reference that distorts area minimally, such as an equal-area projection. For CONUS tool input datasets, NPScape uses USA Contiguous Albers Equal Area Conic USGS (NAD_83) as the spatial reference. Alaska-specific tool input datasets are in Alaska Albers Equal Area Conic (NAD_83) while Hawaii-specific datasets use UTM Zone 5N (NAD_83). UTM WGS84 Zone 55N is used for Saipan and Guam while UTN NAD83 Zone 2S is used for American Samoa.

Re-projecting vector input data:
NPScape tool input vector data can be re-projected prior to use as a tool input. The source dataset should be clipped to an extent larger than the intended area of analysis. Then, after clipping, Repair Geometry must be run to correct geometric errors. Finally, the clipped input can be re-projected to the local spatial reference, followed again with a Repair Geometry operation.

Re-projecting raster input data:
Re-projection to match a local spatial reference is not recommended for raster format NPScape tool input datasets. If re-projection is done, the source tool input raster should be clipped to an area of analysis rectangular extent first. Then, the Processing Extent → Snap Raster environment setting in ArcGIS should be populated with the source input tool raster. Warping will occur but should be less than it would be without the Snap Raster setting.

Alternatively, the AOA extent could be re-projected to the same spatial reference as the NPScape input raster followed by a repair geometry operation. Then, this polygon could be rasterized to a temporary raster dataset with a cell size matching the input raster, setting the snap raster to the input raster to minimize warping. Then, this temporary raster could be used to extract an area from the NPScape tool input raster. Finally, this extracted raster could be re-projected to the desired local spatial reference as described above.

I'm having trouble downloading the tool input dataset. Is there another way to get it?

Many tool input datasets are very large. Please contact the NPScape team to request a custom delivery and/or a custom clipped extent: mailto:NRSS_NRPC_NPScape@nps.gov

My outputs don't show up in my map. What can I do?

The tools use ArcGIS display layers to visualize the metric outputs. If you see a red **!** by the layer name in the map, the layer can't find the feature class or raster to which it is linked. The most common reason is that the Output Geodatabase Name parameter differed from what the tool script expected. Fix the problem by clicking the red **!** and navigating to the output geodatabase. Then, select the correct feature class or raster.

If a multi-feature single-part AOA polygon was used, there will be an output raster or feature class and statistics table for each AOA feature, named with the value of the AOA Field attribute. However, only outputs for the last feature processed will be added to the map automatically. Add the remaining output rasters/feature classes and statistics tables. Use the *.lyr files in the ProcessedData subfolder to symbolize the features.

Literature Cited

ESRI. 2010. U.S. and Canada Detailed Streets. Compiled by Tele Atlas North America (2005), Inc., distributed by ESRI. Redlands, CA. DVD.

Monahan, W. B., J. E. Gross, L. K. Svancara, and T. Philippi. 2012. A guide to interpreting NPScape data and analyses. Natural Resource Technical Report NPS/NRSS/NRTR—2012/578. National Park Service, Fort Collins, Colorado. https://irma.nps.gov/App/Reference/Profile/2184927 (Accessed 20121130).

National Park Service. 2013. NPScape: monitoring landscape dynamics of US National Parks. Natural Resource Stewardship and Science, Inventory and Monitoring Division. Fort Collins, Colorado. http://science.nature.nps.gov/im/monitor/npscape/ (Accessed 20130219).

Appendices

Appendix 1: Known issues

Data extent

The ESRI Data and Maps - U.S. and Canada Detailed Streets, TeleAtlas 2005 (ESRI 2010) streets feature class extends from Alaska to the Mexico border. In Alaska and Canada, road features are sparse and non-contiguous. Care should be taken when interpreting if outputs are produced from this input in these areas since artifacts are likely.

Appendix 2: Reclassification tables

None

Appendix 3: Using custom AOAs and/or local input data

Custom AOAs

The AOA feature class should include a text attribute with a name value for the AOA feature(s). The feature class can contain single or multi-part polygons. If single-part polygons are used, an output raster and statistics table will be produced for each feature, named with the attribute value selected in the AOA_Field parameter.

Local input data

Any roads feature class can be used as input, provided it is in the standard NPScape spatial reference () and has repaired geometry. If weighted road outputs are desired, ensure there is a text attribute in the feature class that can be queried to select road features to be weighted.

Appendix 4: Tool scripts

See Scripts subfolder for Python scripts used by the metric tool(s).

Appendix 5: Tool input data processing details

Source data

By default, NPScape uses the ESRI Data and Maps - U.S. and Canada Detailed Streets, TeleAtlas 2005 (ESRI 2010) streets feature class. This feature class extends from Alaska to the Mexico border. It is available from the ESRI Data and Maps DVD.

Processing steps - Summary

The streets feature class was imported into a version 10.0 file geodatabase and re-projected to USA Contiguous Albers Equal Area Conic USGS (NAD_83) as the spatial reference. Then, the repair geometry tool was run on the re-projected streets feature class.

Update schedule

Every 1-2 years

Appendix 6: Metric data processing details

Source data

ESRI Data and Maps - U.S. and Canada Detailed Streets, TeleAtlas 2005 (ESRI 2010) streets feature class.

Processing steps

The streets feature class was imported into a version 10.0 file geodatabase and re-projected to USA Contiguous Albers Equal Area Conic USGS (NAD_83) as the spatial reference. Then, the repair geometry tool was run on the re-projected streets feature class.

The spatial extent of the ESRI Data and Maps - U.S. and Canada Detailed Streets, TeleAtlas 2005 (ESRI 2010) streets feature class was used to generate 300 km square tiles (with a 10 km overlap). These tile polygons were iterated to generate road density feature classes and density rasters using a batched version of the road density tool script. The tiled output rasters were mosaicked together to generate seamless road density rasters (all roads, major roads).

Using a batched version of the distance from roads script, distance from roads rasters (snapped to the 30 m NLCD 2006 land cover raster), were generated from each tile road density feature class. These tiled rasters were used in a batched version of the area without roads script to create area without roads (all

roads and major roads) polygons. A 500 m distance from roads value was used. The tiled outputs were merged together and repaired. Artifact polygons along the extent edges were removed and the patch area (in km^2) were calculated.

Update schedule
Approximately every 1-2 years