N-SPECT: The Nonpoint-Source Pollution and Erosion Comparison Tool

Overview

N-SPECT is a geographic information system (GIS)-based, spatially distributed screening tool that models basic hydrologic processes, including overland flow, erosion, and nonpoint-source pollution for watersheds (Figure 1). The model operates on annual and event time scales and includes options for user-specified land use and land management scenarios.

The Environmental Systems Research Institute's (ESRI) ArcGIS software and the Spatial Analyst extension are required to run N-SPECT which was designed to be simple so that average desktop machines could run the model quickly. N-SPECT takes advantage of ESRI's geodatabase architecture to store tabular data necessary to run the model. This increases the transparency of the tool and allows users to easily view and manipulate information, such as pollutant coefficients, runoff curve numbers, water quality standards, and file path names.

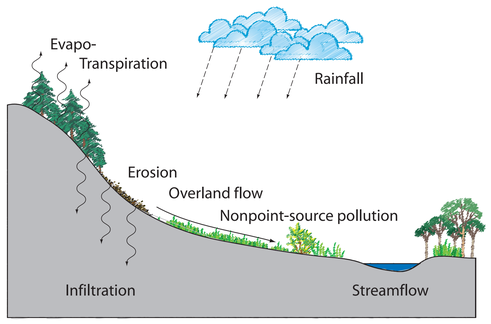
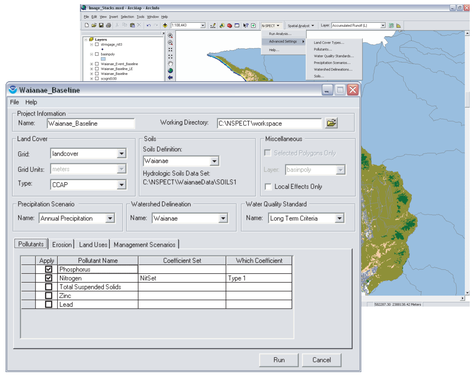
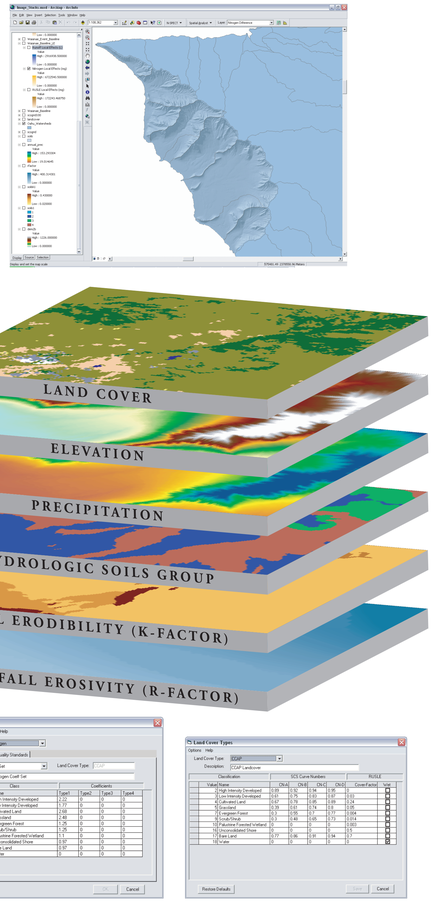


Figure 1. Simplified hydrologic cycle modeled by N-SPECT.



N-SPECT is launched from a menu-driven toolbar in ArcGIS and is controlled through a graphical user interface. Preprocessing tools allow users to hydrologically correct digital elevation models (DEMs) and convert soil polygons to two different grid data sets.

Inputs

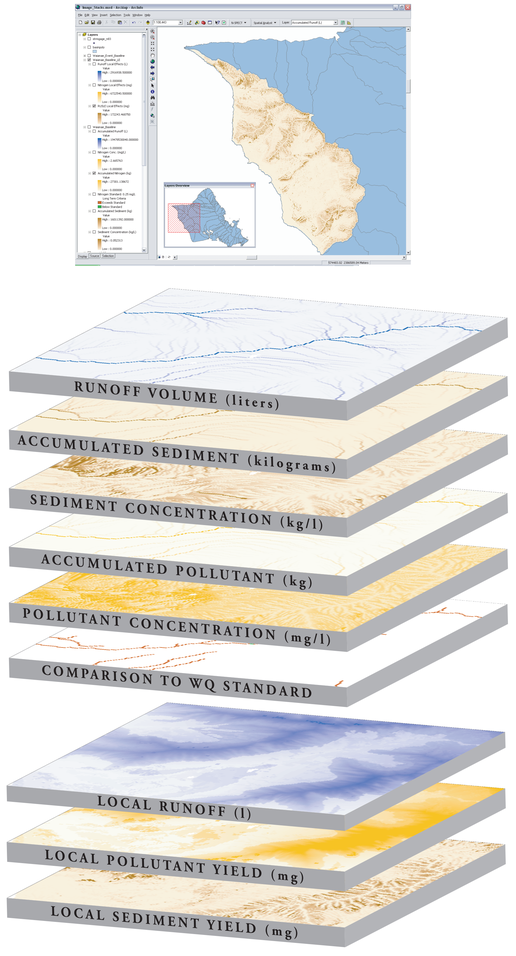


Data inputs required by N-SPECT include preprocessed GIS layers and tabular information. Many of the inputs are easily acquired from on-line sources, such as land cover, elevation, and soil data.

	EVENT	ANNUAL
RUNOFF MODEL	SCS RUNOFF CURVE NUMBER	MODIFIED SCS CURVE NUMBER
EROSION MODEL	MUSLE	RUSLE
NONPOINT-SOURCE MODEL	EVENT MEAN CONCENTRATION	EVENT MEAN CONCENTRATION

N-SPECT incorporates several well known rainfall-runoff, erosion, and nonpoint-source pollutant export algorithms that were modified to run in a GIS environment.

Outputs

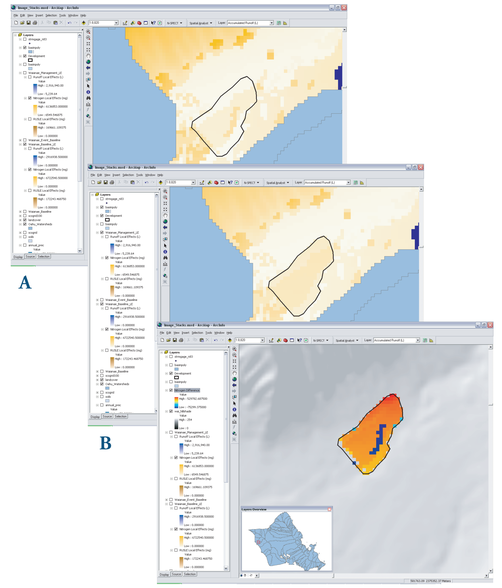


METADATA

Data_Quality_Information:
Lineage:
Process_Step:
Process_Description:
Input Datasets: Hydrologic soils grid:
C:\NSPECT\WaianaeData\SOILS1 Landcover grid:
C:\NSPECT\WaianaeData\landcover Precipitation grid:
C:\NSPECT\WaianaeData\annual_prec Flow direction grid:
C:\NSPECT\wsdelin\Waianae\flowdir Landcover parameters: Landcover type name: CCAP Coefficients: High Intensity Developed: CN-A: 0.89 CN-B: 0.92 CN-C: 0.94 CN-D: 0.95 Cover factor: 0 Low Intensity Developed: CN-A: 0.61 CN-B: 0.75 CN-C: 0.83 CN-D: 0.87 Cover factor: 0.03

N-SPECT generates several different grid outputs. Each output data set is produced with a dynamically built metadata record that includes all the parameter options used to run the model.

Scenarios



Scenario analyses are conducted within N-SPECT using shapefile polygons to define management areas. These areas can be converted to alternative land cover types or can be assigned specific land use runoff curve numbers and pollutant coefficients. The examples above show nitrogen yields (milligrams) for baseline conditions (A), a low density residential management scenario (B), and the difference between the two (C). The 0.2 square kilometer development is predicted to yield an additional 86.7 kilograms of nitrogen under the alternative land management scenario (a 138 percent increase). This translates to a 0.5 percent increase in the accumulated nitrogen load for the entire 14.1 square kilometer watershed.

Conclusion

N-SPECT is intended to be used as a screening tool to help understand and predict the impacts of management decisions on water quality and, potentially, on nearshore coral health. The tool was designed to assist and educate resource managers and planners about nonpoint-source pollution and erosion.

Support documents for N-SPECT include a user's manual, a thorough technical guide, a detailed tutorial, and on-line help files. Staff at the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center provide training and moderate a user e-mail list (see address below).

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NOAA Coastal Services Center
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