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Results and Conclusions

17.1 Running the Model

For purposes of illustrating how a fuzzy system model can be set up to calculate membership functions and condition indices, some Alternative 1 data and program code for the FuzzyEI-Assessortexttrademark is shown. The input data are described in the previous chapters. The specifics will depend upon the software used in a given assessment.

First, linguistic variables and fuzzy term sets are defined—

```
: vegetation -- wetland, riparian and other
:   higher-quality types
declare vegetation
  acreage flt
  area fzset (Tiny Small Moderate Large Huge);
: Vegetation area from 0-1,000 acres.
memfunct vegetation area s-shape
  Tiny    -1E6   0   0 250
  Small     0  250 250 500
  Moderate 250 500 500 750
  Large    500 750 750 1000
  Huge     750 1000 1000 +1E6;
: Wetland quality
declare wetland_quality
  wetqual flt
  quality fzset (Low Moderate High);
```

```
memfunct wetland_quality quality linear
  Low       -1E6  50 150 250
  Moderate   150 250 450 550
  High       450 550 700 1E6;
: hydrology -- increase in runoff over baseline
:   conditions, as percentage
declare hydrology
  hydro flt
  runoff fzset (Very_small Slight Moderate
                Large Heavy);
memfunct hydrology runoff normal
  Very_small -1E6  0  0 25
  Slight        0 25 25 50
  Moderate     25 50 50 75
  Large        50 75 75 100
  Heavy        75 100 100  +1E6;
: aesthetics -- varies with individuals.
declare aesthetics
  beau flt
  beauty fzset (Ugly Nice Beautiful);
memfunct aesthetics beauty s-shape
  Ugly       -1E6 0.0 1.0 4.0
  Nice        1.0 5.0 5.0 9.0
  Beautiful   6.0 9.0 10.0 1E6;
```

The above, while model specific, shows variable declarations, fuzzy sets within each linguistic variable, the universe of discourse, and the support set for each fuzzy term. The vegetation coverage, a simplified measure for the example, is based on a single measured quantity. Wetland quality is a constructed variable that summarizes a set of physical and chemical measurements of functions and values. The hydrology component is a measure of change over baseline conditions Aesthetics is shown as a Type-1 fuzzy set that represents a numeric expression of attractiveness. The model can be much more sophisticated than the one shown here since the incremental increase in computing time for complexity is minimal.

Once the membership functions for the linguistic variables are defined, the applicable rules must be provided. Here are shown only rules for fuzzifying the input values—