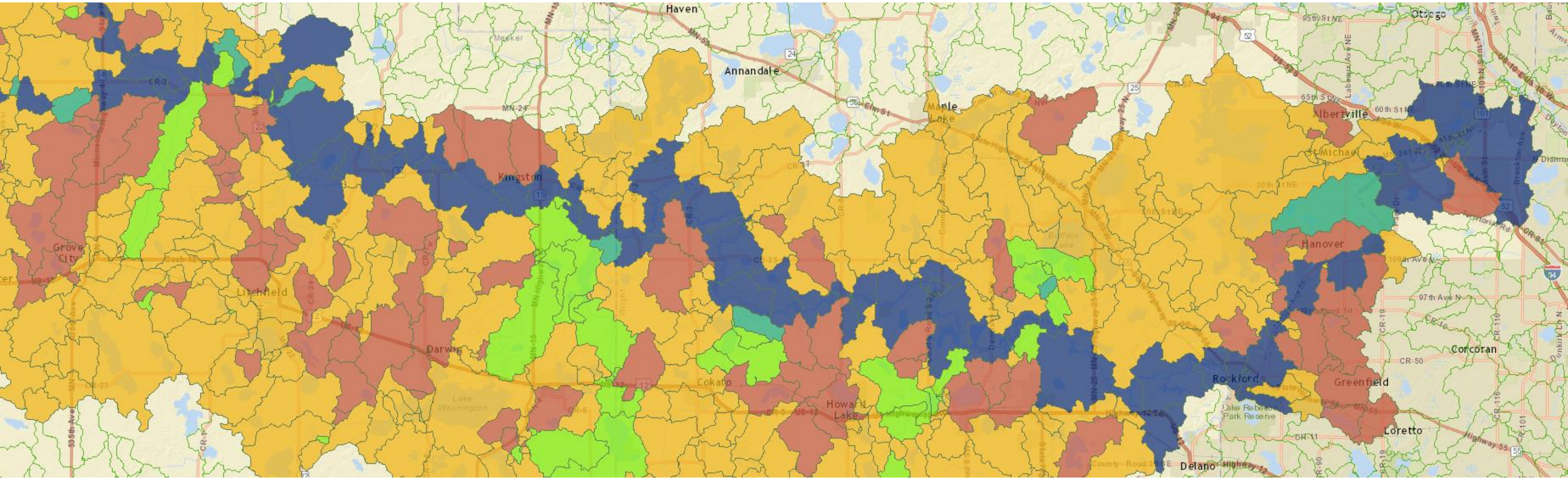


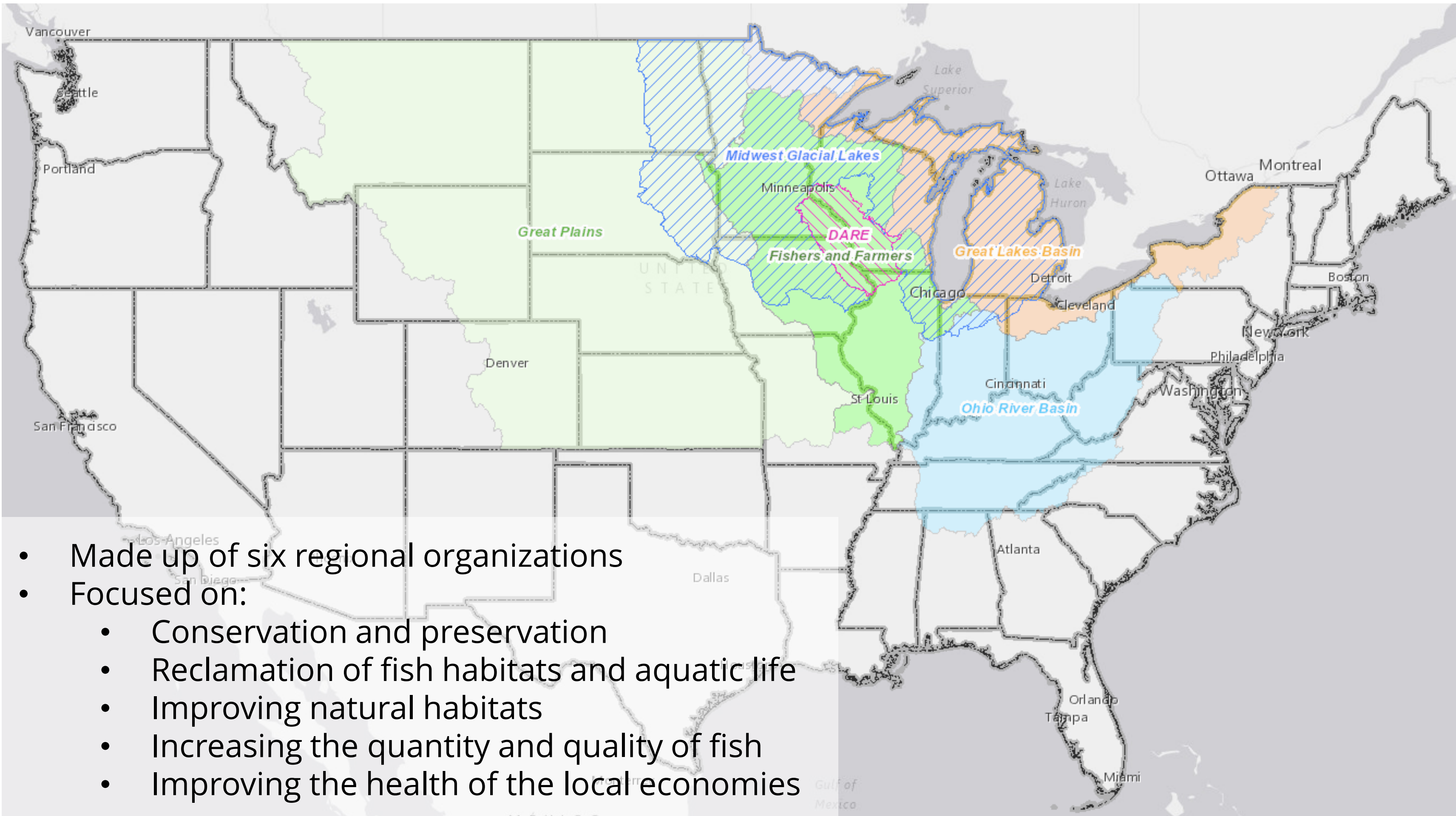
Fish Habitat Modeling using ArcGIS Server

Making Complex Data Usable

Introductions
PRESENTERS

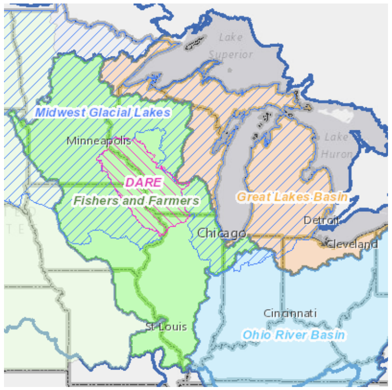
- Jeena Credico
    - Fish and Wildlife Biologist GIS/LC
    - Midwest Fisheries Center
- Fritz Boettner
    - Principal
    - Downstream Strategies
- Michael Strager
    - Associate Professor
    - West Virginia University
- Frank Orr
    - Spatial Solutions Consultant
    - Critigen

Introduction
The Midwest Fish Habitat Partnership



- Made up of six regional organizations
- Focused on:
  - Conservation and preservation
  - Reclamation of fish habitats and aquatic life
  - Improving natural habitats
  - Increasing the quantity and quality of fish
  - Improving the health of the local economies

The Problem
Loads and Loads of Data



Six FHPs

800 HUC8s

33,065 HUC12s

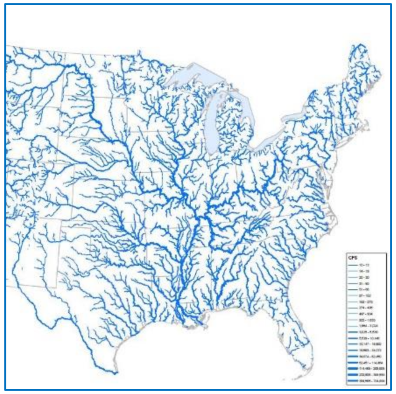
1,032,216 Catchments

- Up to 150 variables per catchment
- Species-specific variables
  - Probability of presence
  - Habitat quality
  - Stress indices
- Landscape variables
  - Land cover
  - Human impact
  - Geology/geography
- Socioeconomic

The Process
Where did this data come from?

US Census

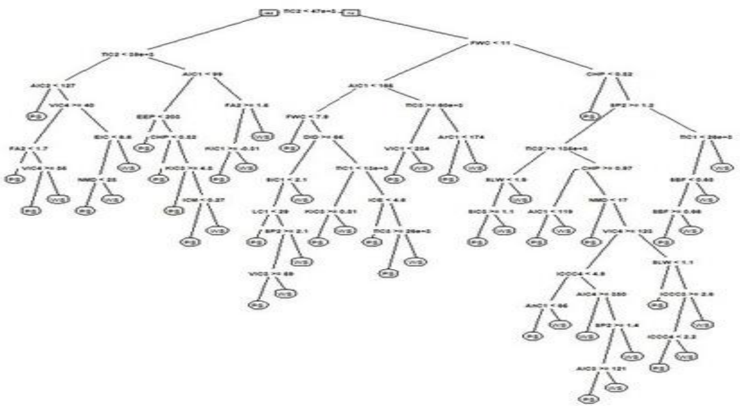
NLCD



NHD PLUS

Fish Surveys

- Plus….
  - USGS
  - Department of Agriculture
  - Office of Surface Mining
  - And so on, and so on….



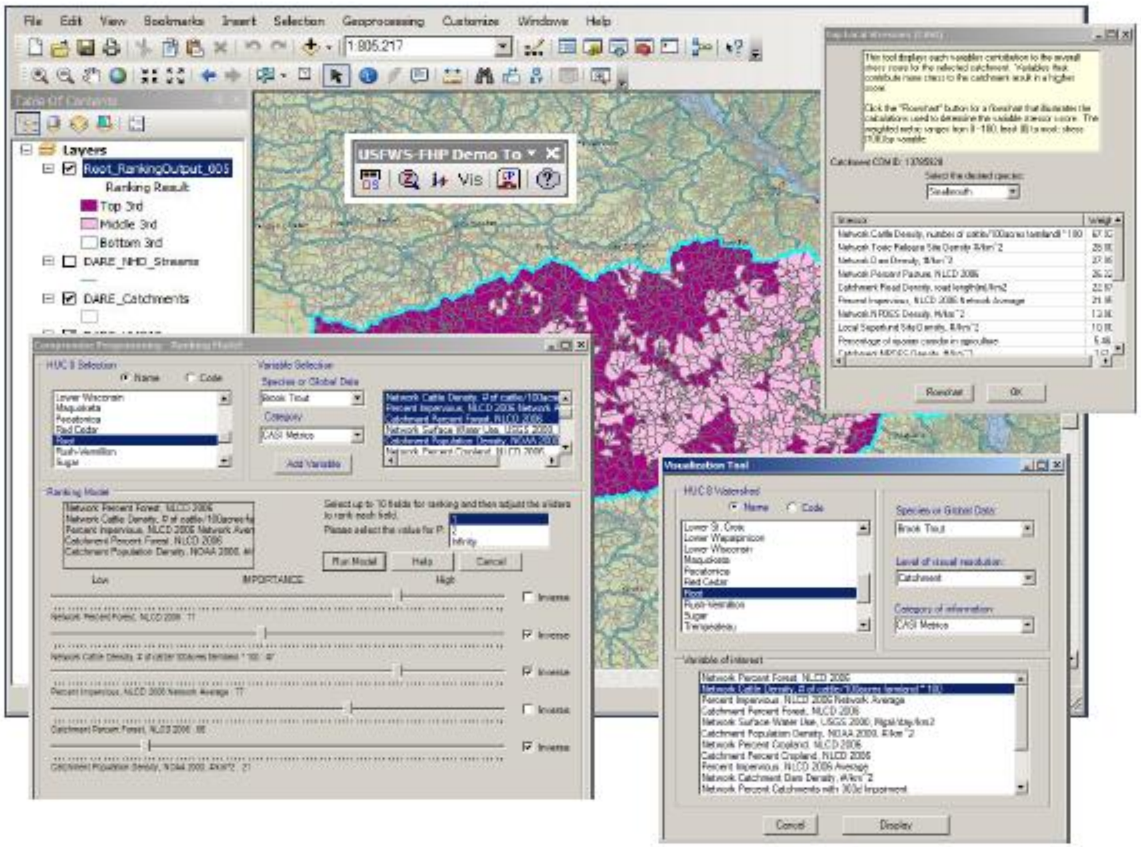
Boosted Regression Tree Analysis

Downstream Strategies building capacity for sustainability

Midwest Fish Habitat Partnerships

U.S. FISH & WILDLIFE SERVICE

The History
Desktop Application



The Good

- Provided ability to visualize and create rankings for fish habitat data
- Very well-designed tool

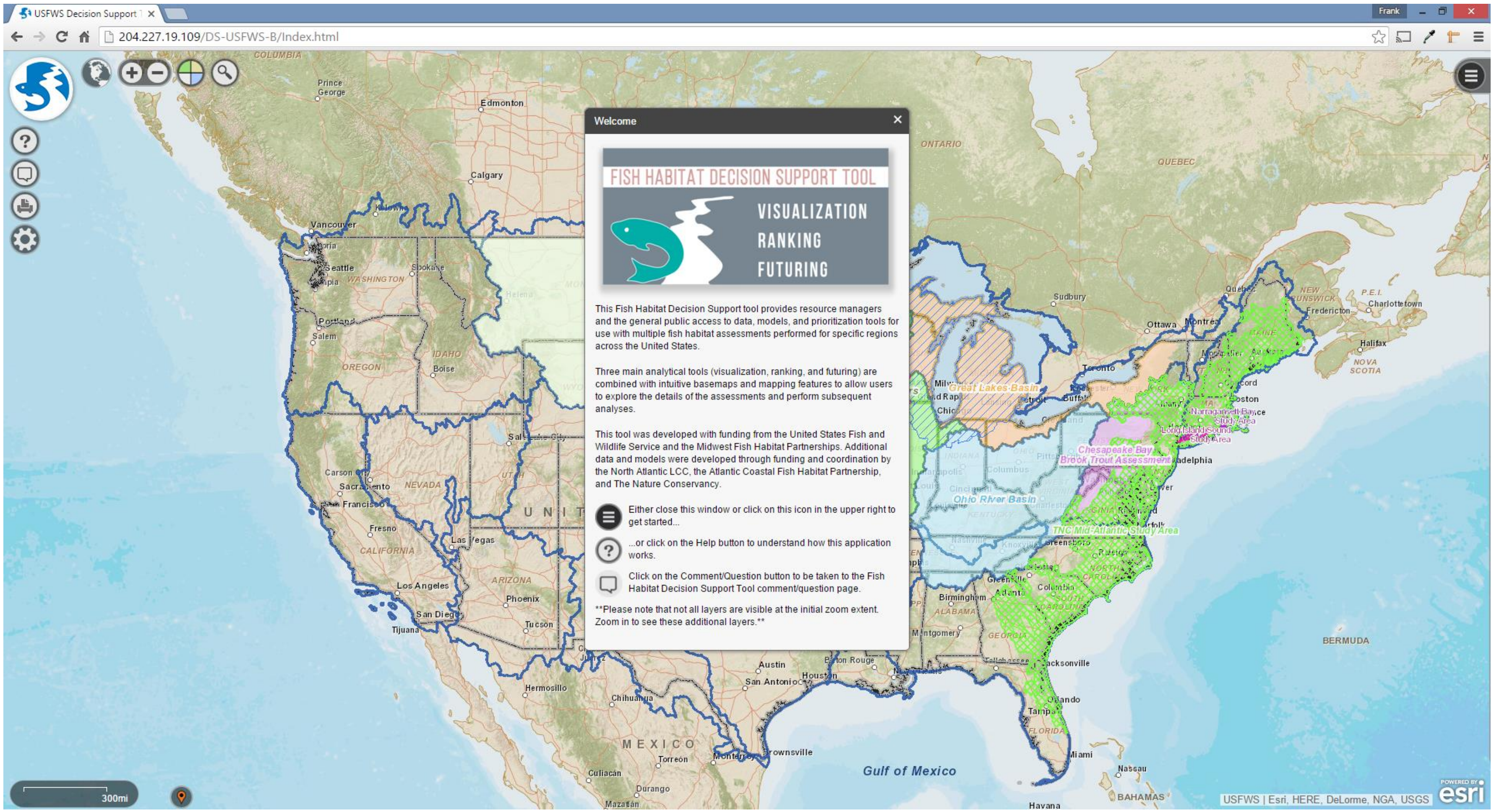
The Not-so-Good

- Had to load data one FHP at a time
- Dependent on ArcGIS version

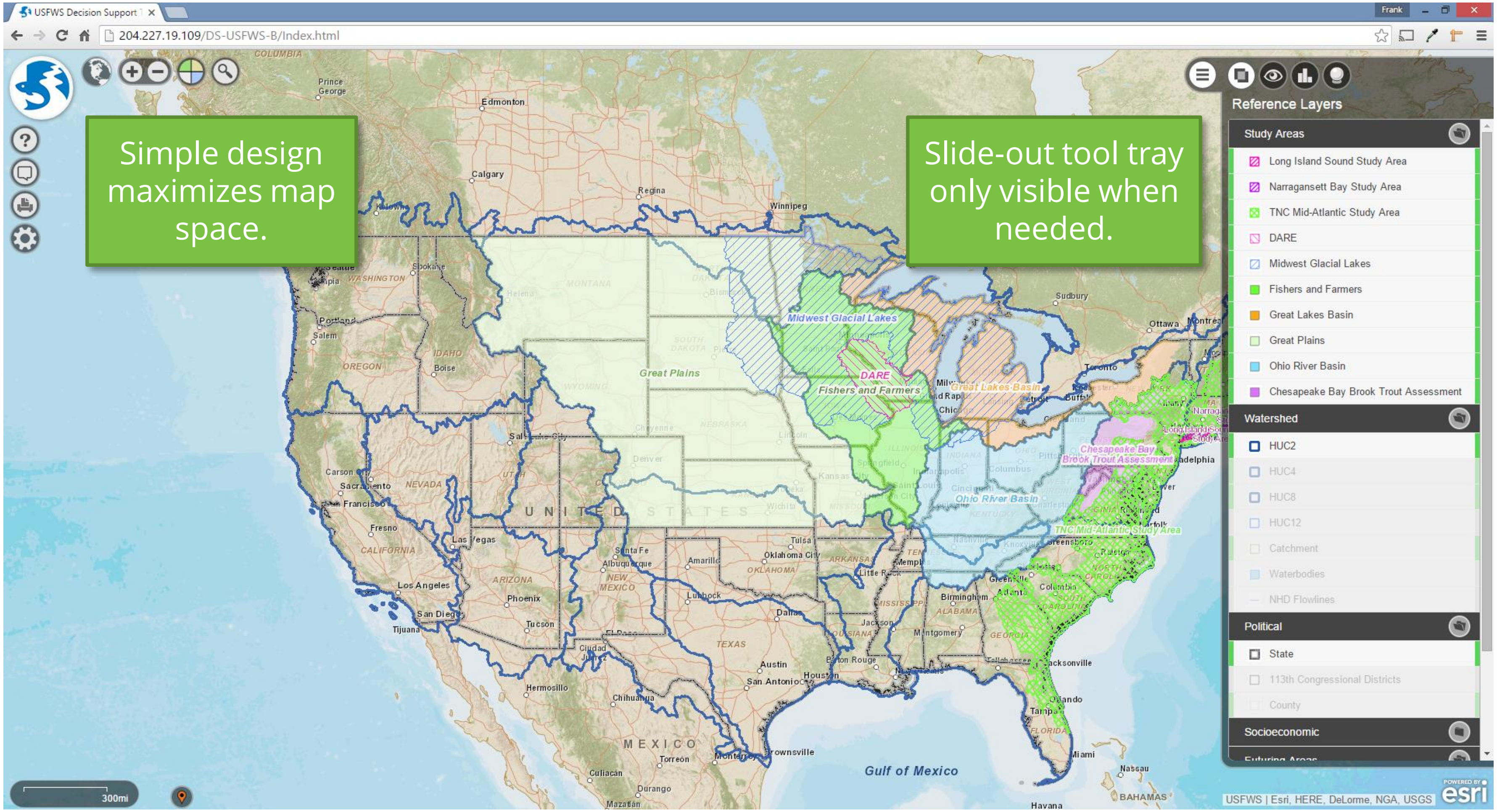
The Bad

- Limited adoption

The Solution
Custom Web-based Mapping Application



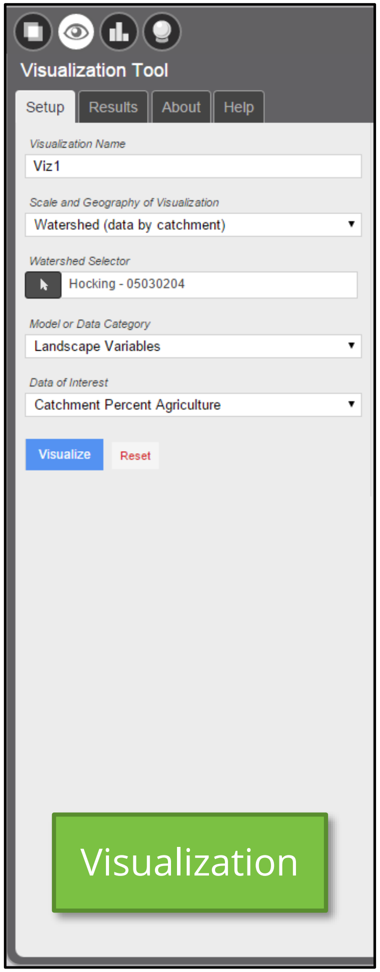
The Design
Custom Web-based Mapping Application

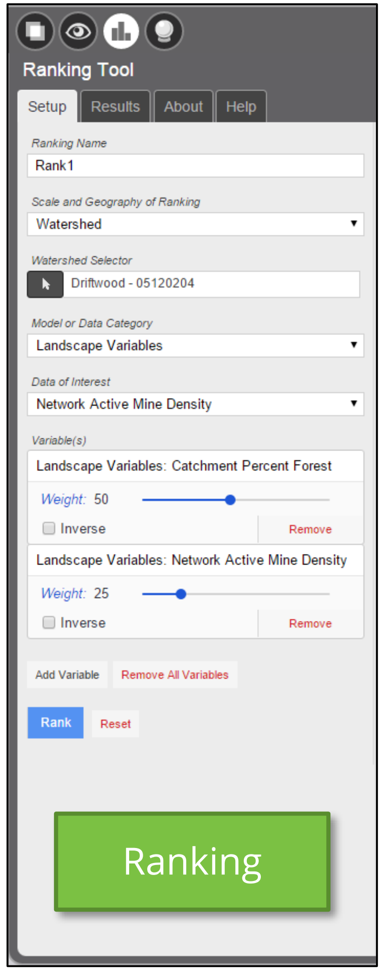


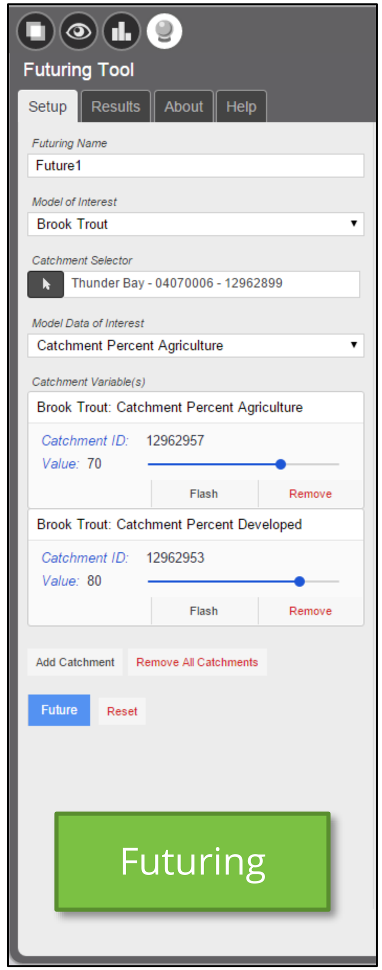
Geek Talk
Obligatory Architecture Slide

- ArcGIS For Server 10.3.1
- JavaScript API 3.14
- Server-side GP services and client-side rendering
- R Statistical Package - Version 3.1.2
- Toastr notifications
- Handlebars.js for dynamic HTML

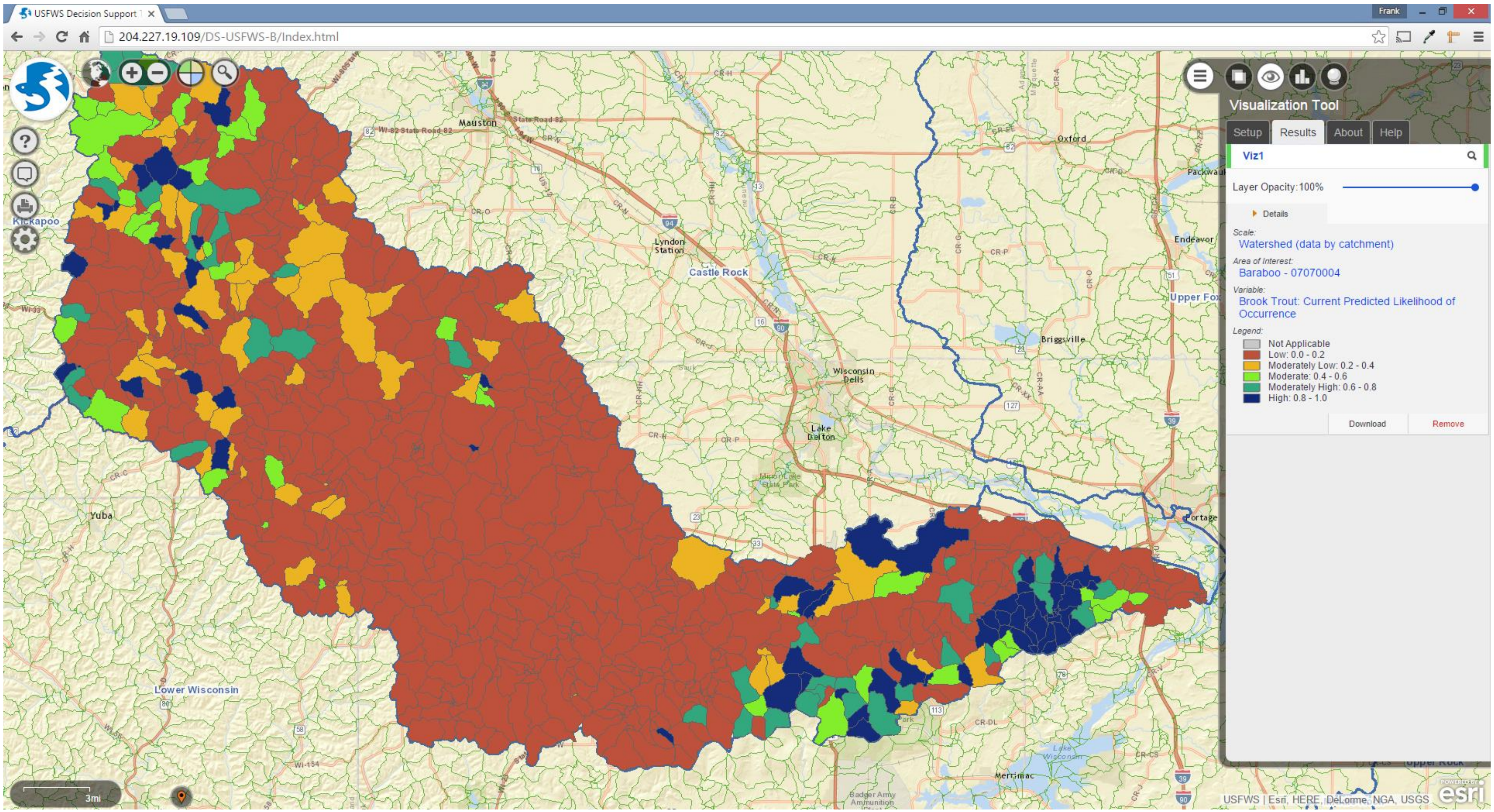
The Tools
Custom Web-based Mapping Application



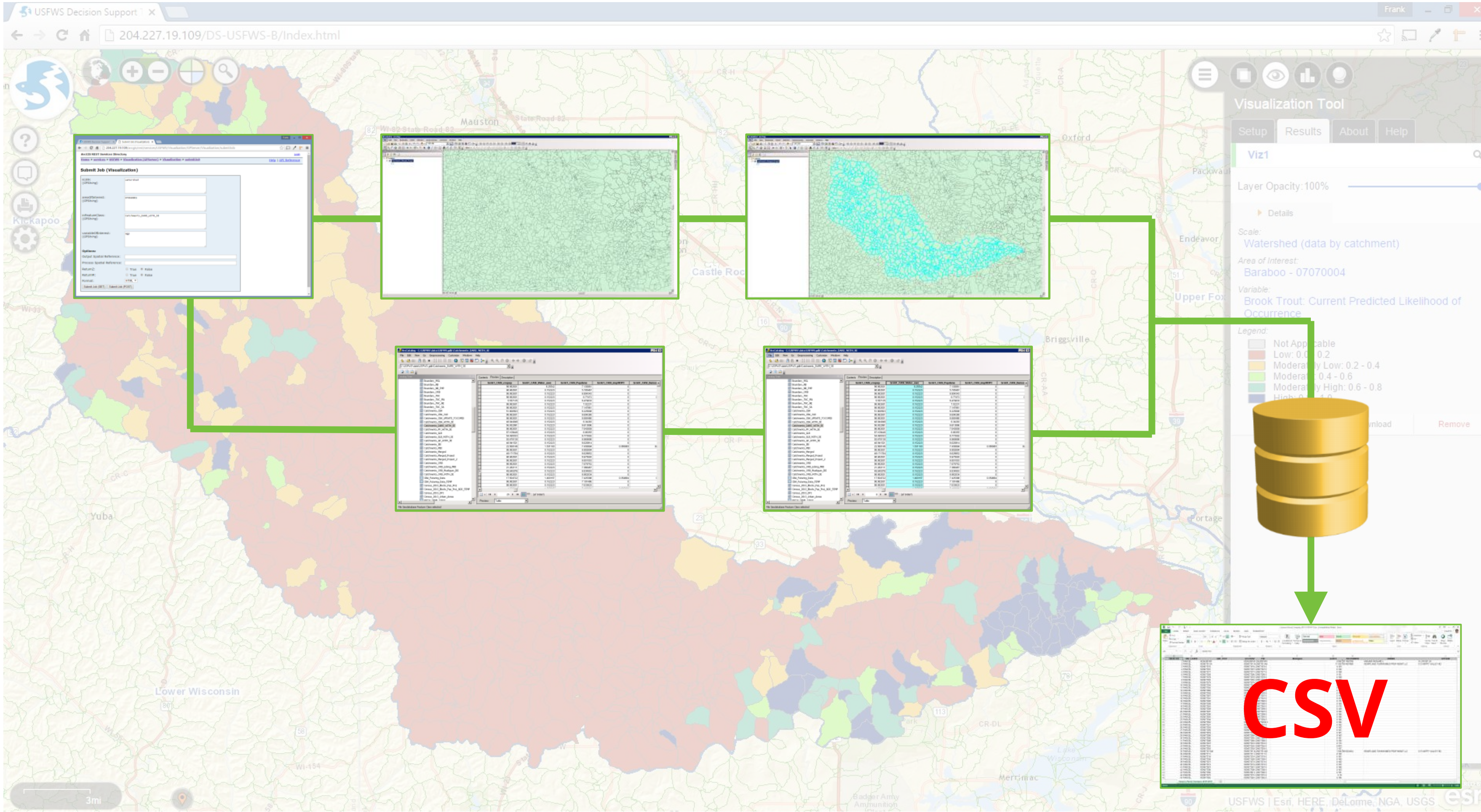




Visualization
Custom Web-based Mapping Application



Visualization – Inner Workings
Custom Web-based Mapping Application



Visualization – Inner Workings
Custom Web-based Mapping Application

```
} else if (renderType == "rendererColdBrktrtBad"){

    var rendererColdBrktrtBad = new ClassBreaksRenderer(genericSymbol, "vizRender");
    rendererColdBrktrtBad.addBreak({minValue: -0.1, maxValue: 0.03, symbol: highSymbol, label: "Low: 0.0 - 0.03"});
    rendererColdBrktrtBad.addBreak({minValue: 0.03, maxValue: 0.10, symbol: mediumhighSymbol, label: "Moderately Low: 0.03 - 0.1"});
    rendererColdBrktrtBad.addBreak({minValue: 0.10, maxValue: 0.20, symbol: mediumSymbol, label: "Moderate: 0.1 - 0.2"});
    rendererColdBrktrtBad.addBreak({minValue: 0.20, maxValue: 0.40, symbol: lowmediumSymbol, label: "Moderately High: 0.2 - 0.4"});
    rendererColdBrktrtBad.addBreak({minValue: 0.40, maxValue: 1.10, symbol: lowSymbol, label: "High: Over 0.4"});

    var optionsArray = [];
    var drawingOptions = new LayerDrawingOptions();
    drawingOptions.renderer = rendererColdBrktrtBad;
    optionsArray[0] = drawingOptions;
    vizLayer.setLayerDrawingOptions(optionsArray);
```

Custom, server-side rendering

Visualization – Inner Workings

Custom Web-based Mapping Application

```
(function (USFWS) {
    'use strict';
    USFWS.dataSchema = {
        "FishHabitatPartnerships": [
            {
                "name": "Narragansett Bay Winter Flounder",
                "abbreviation": "area_HEXNB",
                "VisualResolution": [
                    {
                        "type": "area",
                        "featureClassName": "Hex_NB",
                        "zoomToUrl": "http://204.227.19.109/arcgis/rest/services/USFWS/USFWS_Base_3/MapServer/2",
                        "data": {
                            "metrics": [
                                {
                                    "name": "Predictions",
                                    "models": [
                                        { "dbname": "model5_preds_fish100m2", "alias": "Current Predicted YOY Density ", "renderer": "rendererNBFlounderPreds"  }
                                    ]
                                },
                                {
                                    "name": "Aquatic Habitats",
                                    "models": [
                                        { "dbname": "AREA_WATER", "alias": "Hexagon Area of Water", "renderer": "rendererHexNaturalBreaks"  },
                                        { "dbname": "DIST_SHORE", "alias": "Minimum Distance to Shoreline", "renderer": "rendererHexNaturalBreaks"  },
                                        { "dbname": "DIST_SAV12", "alias": "Minimum Distance to Submerged Aquatic Vegetation (2012 Survey)", "renderer": "rendererHexNaturalBreaks"  },
                                        { "dbname": "AREA_SAV12", "alias": "Hexagon Area of Submerged Aquatic Vegetation (2012 Survey)", "renderer": "rendererHexNaturalBreaks"  },
                                        { "dbname": "PCT_SAV12", "alias": "Hexagon Percent of Water Area As Submerged Aquatic Vegetation (2012 Survey)", "renderer": "rendererHEXNBPercentage"  },
                                        { "dbname": "DIST_SAV06", "alias": "Minimum Distance to Submerged Aquatic Vegetation (2006 Survey)", "renderer": "rendererHexNaturalBreaks"  },
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                                        { "dbname": "PCT_SAV06", "alias": "Hexagon Percent of Water Area As Submerged Aquatic Vegetation (2006 Survey)", "renderer": "rendererHEXNBPercentage"  },
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                                        { "dbname": "PCT_SAVALL", "alias": "Hexagon Percent of Water Area As Submerged Aquatic Vegetation (2006/2012 Survey)", "renderer": "rendererHEXNBPercentage"  },
                                        { "dbname": "LENGTH_HAR", "alias": "Length of Hardened Shoreline Within Hexagon", "renderer": "rendererHexNaturalBreaks"  },
                                        { "dbname": "DIST_HARDS", "alias": "Minimum Distance to Hardened Shoreline", "renderer": "rendererHexNaturalBreaks"  },
                                        { "dbname": "OPEN_WATER", "alias": "Hexagon Area of Open Water Habitat", "renderer": "rendererHexNaturalBreaks"  },
```
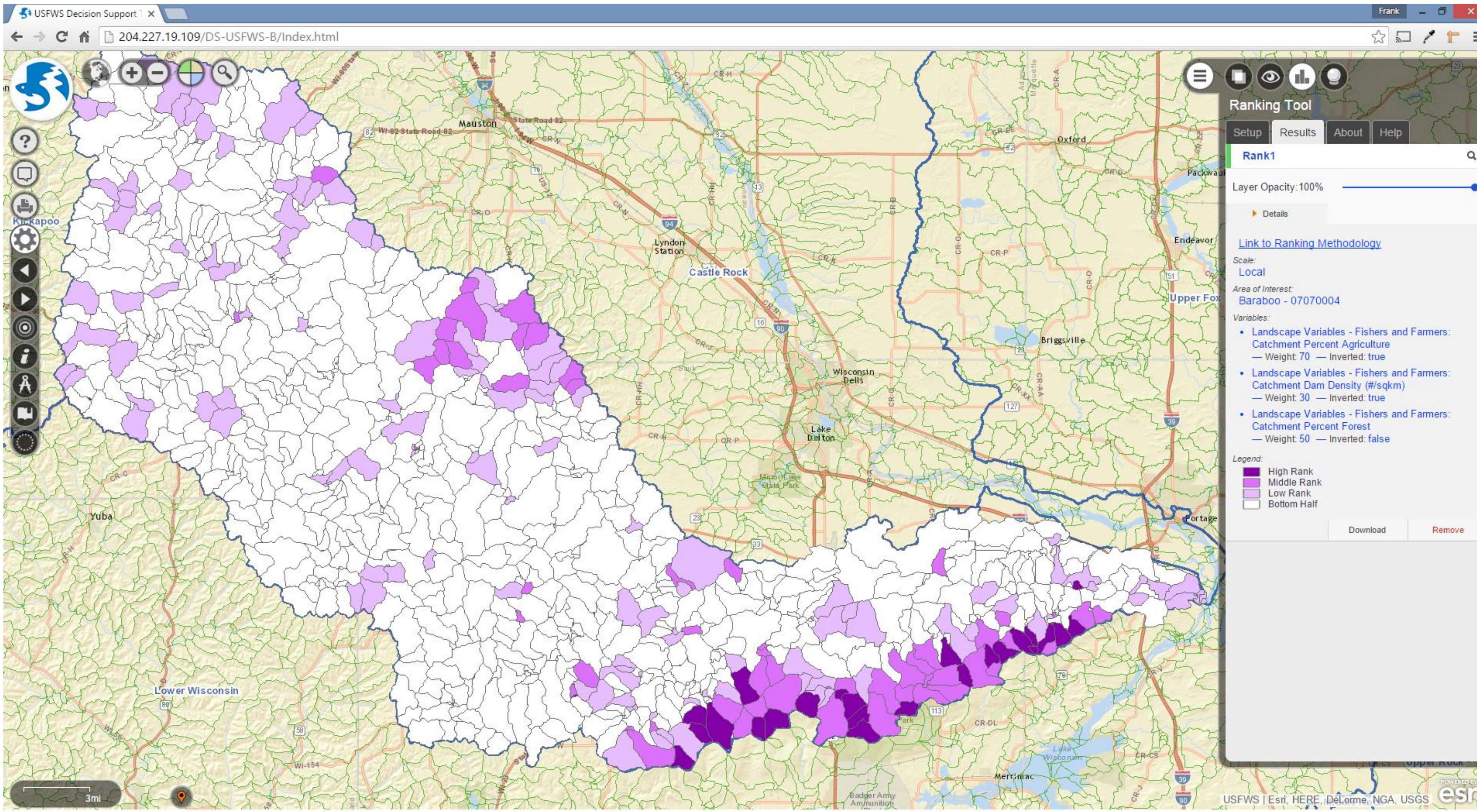
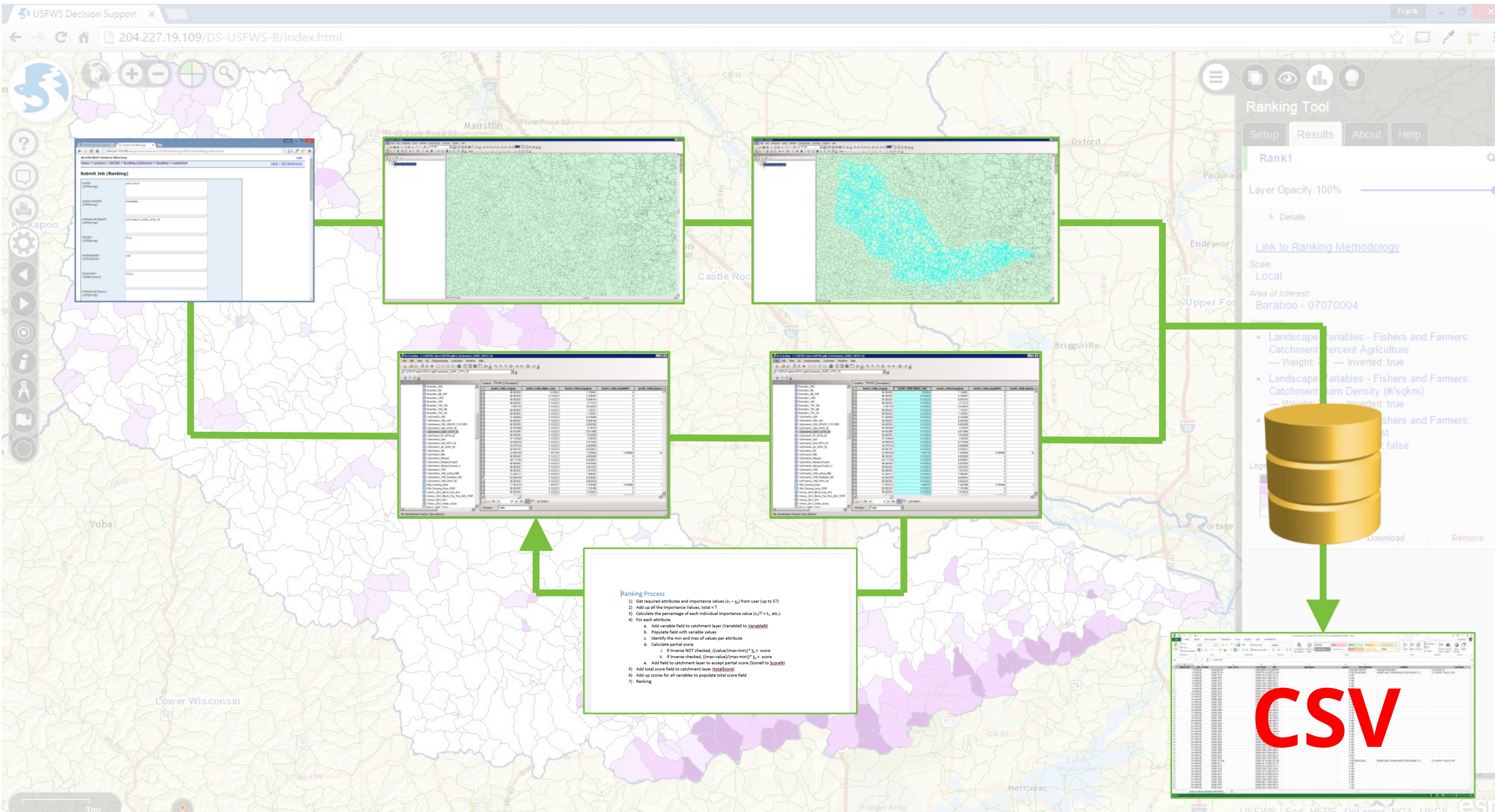

dataSchema.js

Ranking
Custom Web-based Mapping Application



Ranking – Inner Workings
Custom Web-based Mapping Application

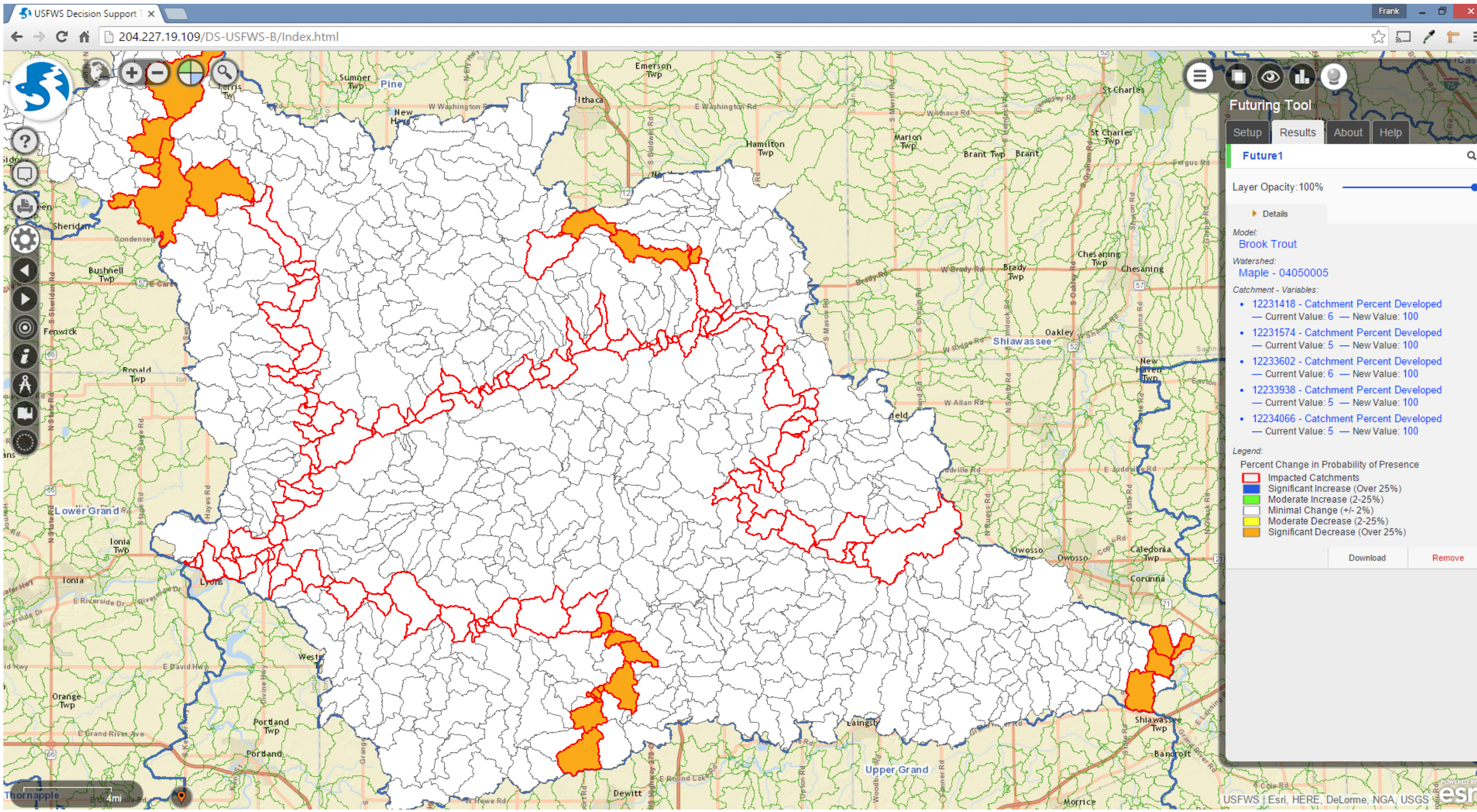


Ranking – Inner Workings
Custom Web-based Mapping Application

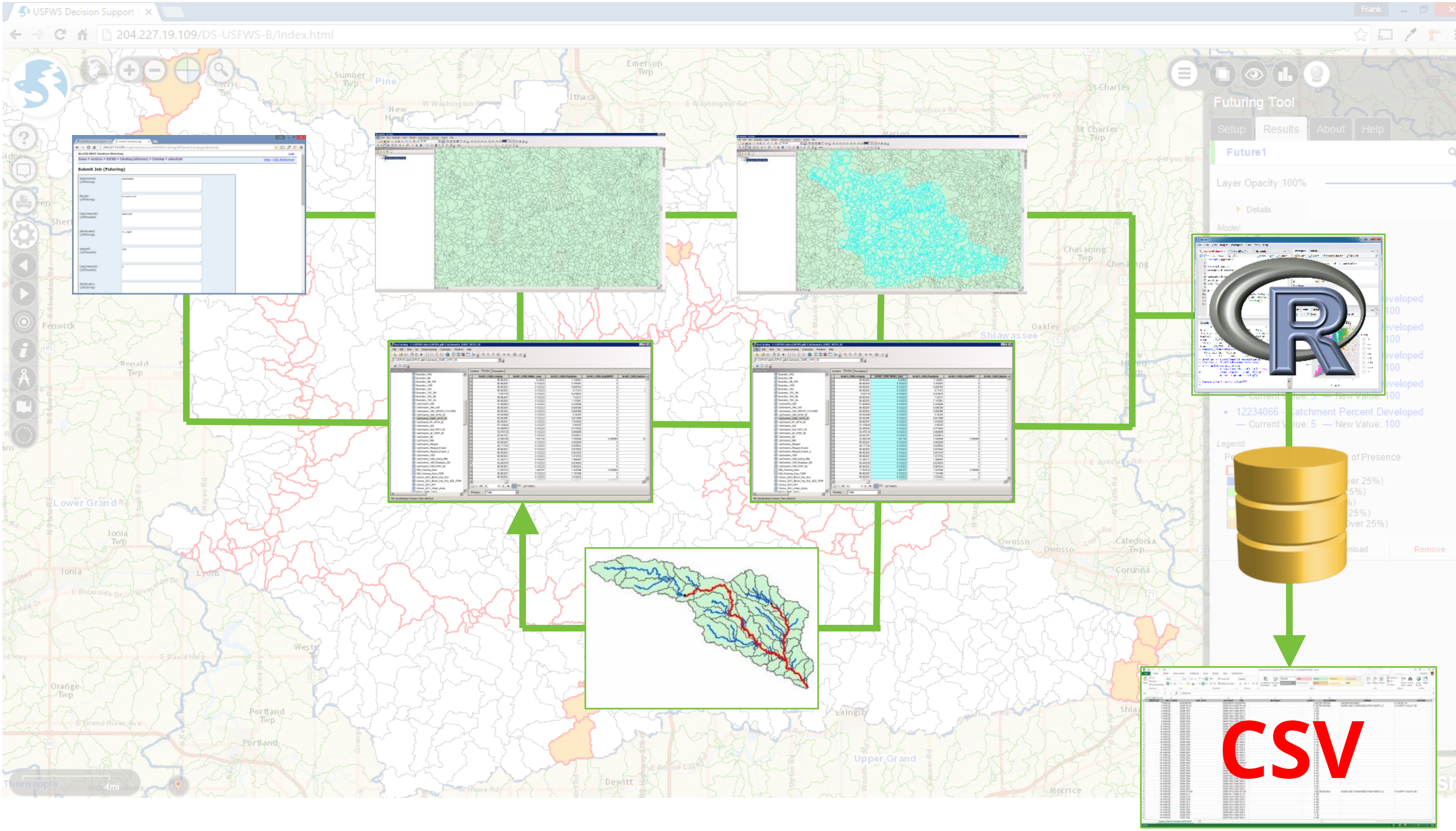
Ranking Process

1) Get required attributes and importance values ($x_1 – x_n$) from user (up to 5?)
2) Add up all the Importance Values, total = T
3) Calculate the percentage of each individual importance value ($x_1/T = t_1$, etc.)
4) For each attribute:
   a. Add variable field to catchment layer (Variable0 to VariableN)
   b. Populate field with variable values
   c. Identify the min and max of values per attribute
   d. Calculate partial score
      i. If Inverse NOT checked, ((value/(max-min))* t_n = score
      ii. If Inverse checked, ((max-value)/(max-min))* t_n = score
   e. Add field to catchment layer to accept partial score (Score0 to ScoreN)
5) Add total score field to catchment layer (totalScore)
6) Add up scores for all variables to populate total score field
7) Ranking

Futuring
Custom Web-based Mapping Application



Futuring
Custom Web-based Mapping Application



Questions
ANSWERS