

**Summary Minutes of the
U.S. Environmental Protection Agency (EPA)
Science Advisory Board (SAB)
Ecological Processes and Effects Committee
Geographic Information System Screening Tool Review Panel Meeting
December 7-8, 2005**

Panel Members: See Panel Roster – Appendix A

Date and Time: Wednesday, December 7, 2005, 8:30 a.m. – Thursday, December 8, 2005, 1:00 p.m.

Location: EPA Region 6 Office, 12th Floor, Fountain Place, 1445 Ross Avenue, Dallas, Texas

Attendees: Chair: Dr. Virginia Dale

Panel Members:

- Mr. DeWitt Braud
- Dr. Ivan Fernandez
- Dr. Carol Johnston
- Dr. William Mitsch
- Dr. Michael Newman
- Dr. Thomas Mueller
- Dr. James Oris
- Dr. Charles Rabeni
- Dr. Amanda Rodewald
- Dr. Mark Ridgley
- Dr. James Sanders
- Dr. David Stoms
- Mr. Timothy Thompson
- Dr. Robert Twiss

EPA SAB Staff:

- Thomas Armitage, Designated Federal Officer
- Anthony Maciorowski, Associate Director, EPA Science Advisory Board Staff Office
- Diana Pozun, EPA Science Advisory Board Staff Office

Other EPA Staff:

- Javier Balli, U.S. EPA Region 6
- Sharon Osowski, U.S. EPA Region 6
- Mark Potts, U.S. EPA Region 6
- Annette Smith, U.S. EPA Region 6

Others Present: Jeff Danielson, Lockheed Martin

Meeting Summary

The discussion followed the issues and timing as presented in the meeting agenda (Appendix B)

Convene Meeting, Call Attendance

Thomas Armitage, Designated Federal Officer (DFO) for the Geographic Information System Screening Tool (GISST) Review Panel opened the meeting at 8:30 a.m. He stated that the Science Advisory Board (SAB) is a chartered federal advisory committee whose meetings are public by law. He reviewed Federal Advisory Committee Act (FACA) requirements, the Panel's compliance with federal ethics and conflict-of-interest laws, and the panel formation process. Armitage stated that, as DFO he would be present during Panel business and deliberations. He stated that records of Panel discussions are maintained and summary minutes of the meeting would be prepared and certified by the Panel Chair. Armitage then asked the Panel members to identify themselves and their affiliations.

Introductory Remarks

Anthony Maciorowski, SAB Associate Director for Science, welcomed the members of the Panel and thanked them for serving.

Virginia Dale, Panel Chair, thanked the members for serving on the Panel and reviewed the agenda for the two-day meeting. She stated that the Panel would hear presentations from EPA on the GISST framework and methodology as well as a case study application of the tool. The Panel would then deliberate on six charge questions and develop draft responses to be provided in a report to EPA. Dale stated that on the second day of the meeting the Panel would begin developing the draft report. She then briefly reviewed the process of developing an SAB report, stating that after the Panel had completed the report it would be sent to the chartered SAB for final approval and transmittal to the EPA Administrator. After a brief discussion of the agenda, Dr. Dale introduced the first EPA speaker.

Overview of the GISST Framework, Methodology, and Uses

Mark Potts, Deputy Associate Director of the Compliance Assurance and Enforcement Division in EPA Region 6 was the first speaker. He presented background information on the development of the GISST. He stated that the GISST was a useful tool for evaluating cumulative environmental impacts in the context of decisions required under the National Environmental Policy Act (NEPA). He stated that it was essential for EPA to have such tools to inform decision making, and that the GISST was particularly useful as a source of information for NEPA decisions because EPA generally had only 30-45 days to make such decisions. He stated that the GISST was not a substitute for field investigations, but it was a useful survey tool. He stated that he was looking forward to

the SAB review and receiving the Panel's recommendations for improvements in the GISST.

Sharon Osowski, of EPA Region 6, presented an overview of the GISST framework, methodology, and uses, and reviewed the charge questions to the Panel (Presentation provided in Appendix D, charge questions provided in Appendix C). Osowski noted that there had been a request from a Panel member to load a GISST case study into Google Earth so it could be evaluated by the Panel. She stated that the EPA had not been able to do this. However, a detailed case study illustrating the use of the GISST would be presented.

Osowski reviewed the uses of the GISST. She stated that the GISST was an important tool for conducting screening level assessments needed by EPA for time-critical activities. She stated that GIS coverages and databases were used in the GISST and a scoring structure (using a 1-5 scale) was imposed on the data.

Osowski presented the charge questions to the Panel. The first charge question focused on the GISST methodology. Osowski stated that EPA sought the Panel's views on whether the 19 most frequently used GISST criteria were reasonable and appropriate for evaluating environmental impacts in initial assessments. Osowski described the 19 frequently used criteria. She noted that some of these criteria reflected vulnerability scores, some reflected impact scores, and some reflected both impact and vulnerability.

The second charge question focused on the GISST 1-5 scoring system and whether it was reasonable and appropriate to use the scoring system and GISST datasets for an initial assessment of potential project impacts. Osowski described how the criteria and scoring system were developed. Criteria were developed on the basis of the assessment needs for particular projects, available data, and program interest. A 1-5 scoring scale was developed because scale was easy to understand and discern on maps. The 1-5 scoring intervals for criteria were developed by analyzing data for natural breaks and considering regulatory thresholds, policy objectives, and expert opinion. Osowski noted that in GISST evaluations EPA had used readily available data (in electronic format) that had some documented level of QA/QC. EPA tried to match data with the criteria.

The third question focused on whether the mathematical formula used in the GISST to derive cumulative impact and vulnerability scores was appropriate for use in screening or initial level assessments. The question also asked for comments on the approach used in the Interstate Highway 69 (I-69) corridor case study. Osowski described the GISST formula or "algorithm" as well as the approach used to evaluate the I-69 highway corridor.

The fourth and fifth charge questions focused on whether it was reasonable and appropriate to use the GISST to prioritize potential environmental impacts for further analysis, and to evaluate alternatives for decision making. The sixth charge question asked for Panel recommendations to enhance the GISST User's Manual and documentation.

The Panel asked questions about the criteria. A Panel member asked EPA staff to provide a definition of the vulnerability in the context of the GISST. EPA Staff responded that vulnerability could be defined as susceptibility to impacts and concern “on the ground.” The Panelist asked whether vulnerabilities and impacts were considered independently in the GISST. Osowski responded that they were not.

Panel Questions on the GISST Framework, Methodology and Uses

The Panel asked questions about how GISST criteria scoring intervals were derived. EPA Region 6 GIS staff responded that EPA had used software to look at natural breaks in the available data and assigned scoring intervals based on those breaks. Panel members asked whether region-wide data were used to derive natural breaks. EPA staff responded that they had tried to use region-wide data for these analyses. After the criteria were developed they were reviewed by a group of GISST developers, and some of the criteria were placed in a “provisional” bin because additional data were needed before they could be used.

The Panel asked EPA staff to describe the process of selecting criteria for use in evaluating a project. EPA staff explained the process, noting that the individual criteria were not thresholds, but they were used together for an evaluation of cumulative impact. The decision to use criteria for a particular evaluation was made by EPA, taking into consideration the kind of project and possible impacts. Panel members noted that it was important to provide information on the caveats associated with use of the criteria and the tool. The GISST should not be used by people who do not understand the environmental assessment process for which it was developed.

A panelist commented on the need for an evaluation methodology that reflects dynamic, not static, system impacts. He also noted that the 1-5 ranking on one project may not relate to a similar score on another project because different criteria may be used. He indicated that sensitivity analyses could be conducted to evaluate the potential use of different criteria in the GISST. EPA staff responded that they would like to run sensitivity analysis but have not yet done this. They also stated that there was an immediate need for the GISST to provide information for NEPA decisions. Panelists noted that EPA might consider developing a weight of evidence approach for evaluations.

A panelist stated that he was sensitive to the immediate need for a tool to enable rapid NEPA decisions (within 30 days), but he noted that EPA staff had referred to the GISST as a survey tool. He asked how it was used as a survey tool. EPA staff responded that it was often important to determine whether a more detailed analysis of potential impacts was needed, for example in consideration of endangered species impacts. The GISST was used as a tool to provide preliminary information for more detailed analysis. EPA staff described the I-69 case study as an example of an initial screen that was used to focus resources for further analysis. The GISST was not used in that case to determine a regulatory threshold.

A Panel member asked whether EPA had undertaken a “larger” Agency initiative to complete the kind of work that Region 6 had been unable to do because of resource limitations (i.e., further develop GIS-based analytical tools). EPA staff responded that the Agency had developed other GIS-based tools and that the SAB had reviewed some of them (e.g., the Southeast Ecological Framework, the Critical Ecosystem Assessment Model, the Regional Vulnerability Assessment methods). The Panel member indicated that he believed the EPA Regions needed more help to develop GIS-based analytical tools and that the SAB should recommend that EPA provide such support.

The Panel asked questions about the GISST scoring system. A panel member asked for further clarification of how the GISST criteria were developed and whether GISST scores were ordinal or cardinal numbers. He noted that the scores were apparently ordinal numbers, but he needed assurance that the basic math used in the scoring system was correct. EPA staff responded that the criteria scoring intervals were developed by analyzing natural breaks, evaluating regulatory thresholds, policy objectives, and other data. A Panel member commented that EPA might want to consider establishing a standing panel to further develop GISST criteria.

A panelist asked how GISST analyses were conducted (who, what, when). He also asked EPA staff to describe the GISST output. EPA staff responded that Region 6 GIS staff and their contractors wrote the GISST code and developed maps and excel spreadsheets used in the analyses. The outputs were GISST maps and raw scores. This information was provided to EPA’s NEPA staff. The system had not yet been automated and could not be run by NEPA staff on a desktop. A panelist noted that there were probably other groups of people (e.g., Fish and Wildlife Staff, Texas Highway staff, and others) who would need to look at the GISST results.

The Panel asked questions about the GISST algorithm. A panelist asked how the total area of a project was determined for evaluations. EPA staff responded that this information was provided on project applications in the NEPA process. For some analyses, such as the feedlot evaluation conducted in Region 6, the project area was a policy question. In the feedlots evaluation, EPA was interested in determining the cumulative impact of feedlots throughout Region 6.

A panelist asked EPA to explain the origin of the GISST algorithm (i.e., how it was originally developed). He asked whether the algorithm had been used in other projects, whether it had been peer reviewed, and whether it was consistent with other evaluation tools used by EPA. EPA staff responded that EPA risk assessors had originally developed the GISST algorithm. A Panelist asked how one could tell whether a GISST score is “good” or “bad”. He asked what relative scale was used. EPA staff responded that they had struggled to answer that question. EPA staff noted that it might be possible to determine ends of the score spectrum by looking at time series data.

The Panel asked further questions about the project areas used for GISST analyses. A Panelist asked why EPA had selected the 11 digit hydrologic unit for use in the GISST. EPA staff responded that this was the smallest unit delineated at the time and was the

smallest unit that could be used. A panelist asked whether GISST scores were ever made public. EPA staff responded that this information was communicated to applicants in the NEPA process. The Panel asked how the GISST maps displaying the scores associated with various areas were developed. EPA staff responded that the maps were computer generated based on breaks in the data.

At 10:10 a.m. the Chair stated that the Panel would break until 10:25. At that time the meeting would resume with a discussion of the Interstate Highway 69 case study.

Interstate Highway 69 Case Study

At 10:25 a.m. the Chair reconvened the Panel and asked EPA to present the Interstate Highway 69 case study. Sharon Osowski of EPA Region 6 presented the case study. She stated that the I-69 study was undertaken to evaluate the environmental vulnerability of parts of the congressionally mandated interstate highway corridor. Analysis was needed to narrow the corridor to an appropriate size for a more detailed field level study. A decision was made to use the GISST for this analysis because the highway project was complex, and a large amount of data had to be analyzed. Technical staff from stakeholder agencies agreed on the data sets to be used in the analysis. Nineteen criteria were used in the analysis. New criteria were developed for the analysis, and the GISST formula was modified because a GISST score for the entire corridor was not useful. A grid method was used to evaluate 1km² areas within the corridor. Osowski described the analysis and displayed maps that were generated to depict the vulnerability of grids in the highway corridor.

Panel members asked a number of clarifying questions about the case study. A panelist asked whether each grid area had an associated score for each of the 19 criteria used in the analysis. EPA staff responded that the criteria were scored in each grid area. A Panel member asked whether EPA applied weights to the criteria. EPA staff responded that all of the criteria were weighted equally. A Panel member asked whether a two stage evaluation process might be justified (i.e., first conducting an ecological assessment to be followed by a socioeconomic evaluation). EPA staff responded that the Agency had not conducted the analysis in that way, but it might be a good approach.

A Panel member asked whether any of the criteria could receive a score of zero. EPA staff responded that the value of one was the lowest score assigned to each of the criteria. However, a floodplain might receive a score of zero if no data were available.

A Panel member asked how the GISST analysis would be used in the I-69 case. EPA staff responded that the results were transferred to the Federal Highway Administration. Panel members asked several questions about the scale of data used for the analysis. EPA staff noted that the watershed unit was not used for the I-69 analysis. A Panel member noted that some of the socioeconomic data might not be applicable on both national and local scales (e.g., minority may be defined differently at national and local scales). The panelist stated that GISST criteria should be applied differently in different regions. The Panel asked several questions about how economically stressed areas were

evaluated using the GISST. EPA staff responded that areas with high scores for economic stress would receive higher scores for vulnerability. A Panel member asked whether brownfields would receive high scores for economic stress. EPA staff responded that they would.

A Panel member stated that a concern in multicriteria analysis (such as GISST evaluations) was that the criteria could be correlated. He asked EPA staff whether any effort had been undertaken to eliminate some of the criteria that may be correlated. EPA staff responded that they were aware of possible “double counting” of the criteria, but they did not want to remove criteria because there were valid reasons for using them in GISST evaluations. EPA staff stated that sensitivity analysis could be performed to evaluate the criteria. A Panel member asked EPA staff how the cumulative GISST score and individual criteria scores were used in GISST analyses. EPA staff responded that the cumulative scores were used along with the individual criteria scores to conduct an evaluation. The individual scores provided a better indication of the kinds of impacts associated with a project. A Panel member noted that it appeared EPA was not focusing on nonpoint source pollution in GISST analyses. He stated that digital elevation models could be used to assess nonpoint source impacts. Another Panelist noted that the GISST was an improvement on the way analyses had been conducted in the past.

The Panel discussed the impacts and vulnerabilities represented by the GISST criteria. A Panelist stated that some of the criteria were surrogates for other things of concern (e.g., the hazardous waste criterion). The panelist stated that the GISST documentation should contain a clearer description of the criteria and how they represent impacts and vulnerabilities. Another panel member stated that, based on case example presented, EPA appeared to have used an informal criteria weighting process in GISST evaluations. The Panel member stated that consideration of weighting was very important. As an illustration of this, the Panel member stated that endangered habitat might not show up as a concern in a cumulative GISST score because it could be masked by other criteria. EPA staff responded that endangered species issues would be considered separately but agreed that some potential impacts could be masked in cumulative scores. EPA staff stated that the GISST was a tool to look at cumulative impacts, and that informal weightings were used to the extent that it was important to look at the individual criteria scores in conducting an evaluation.

The Chair thanked Sharon Osowski for her presentations and stated that she wanted to move to the next topic on the agenda, Panel deliberation on the charge questions (provided in Appendix C). Before beginning the Panel discussion, the Chair asked if anyone present at the meeting wished to provide public comments. There were no public comments. The Chair then asked the lead panel discussants to respond to the first charge question.

Discussion of Charge Question 1.2

Panelists provided comments in response to charge question 1.2 (Appendix C). A panelist stated that EPA appeared to be looking at three types of vulnerability in GISST

evaluations: 1) systems that were vulnerable because they are already under stress, 2) pristine systems that were important regionally or nationally, and 3) areas that had unique or distinctive features that made the areas important (e.g., sole source aquifer). She noted that in the GISST these three types of vulnerability were mixed into one vulnerability measure that might miss one kind of site. The panelist suggested that it might be better to separate these kinds of vulnerability in an evaluation. The Chair suggested that there might be an additional type of vulnerability measured, systems that were highly stressed and could tolerate stress.

Another panelist stated that additional information was needed in Appendix A of the GISST User's Manual to define the criteria and describe what they represented. The Manual should provide more information describing what the GISST is and how it was used. The panelist questioned whether the GISST was a tool, scoring system, or process.

A panelist stated that a web-based mechanism was needed to provide GISST users more information about the criteria and how they should be applied in an analysis. He stated that it is not clear how to include or exclude criteria. Panelists stated that if the GISST documentation was intended to be a user's manual, additional information was needed for stakeholders. A panelist commented that many of the indicators seemed to overlap and that more guidance was needed for selection of the criteria.

Other panelists agreed that the definitions of the criteria in Appendix A of the user's manual were not clear. If the GISST were to be used for decisions, it would be incumbent upon EPA to provide better justification of the scores.

A panelist noted that the general impact assessment method used in the GISST might not be as useful as a method for looking at different kinds of projects. He stated that it was necessary to break the impacts into major categories or types (i.e., CAFO, nutrient, etc.). The panel discussed developing templates to identify criteria for potential use in the GISST analyses on the basis of types of projects evaluated. A panel member noted that the criteria in the GISST User's Manual might "counter" each other. Panelists discussed the importance of weighting the criteria and possibly developing a hierarchy of data layers for use in an analysis. It was suggested that pattern recognition process might be used to evaluate projects rather than relying on a single score. EPA staff responded that the EPA Region 6 Office had not conducted that kind of analysis. A panelist suggested that colors could be used in developing maps, and that overlapping colors could be used to evaluate impacts.

Another panelist acknowledged that it was difficult for EPA to complete analyses for NEPA decisions in a short period of time. He suggested that GIS could be used to complete sophisticated modeling that could be used to develop support tools for NEPA decisions. He noted that with the large number of criteria included in the GISST, it was difficult to account for overlapping factors. He suggested that EPA keep in mind the principle of "Ocaam's Razor" and consider using a smaller number of important criteria for a decision. Panelists suggested that EPA consider convening expert panels to determine the most important criteria for evaluating various kinds of projects.

A panelist noted that the SAB had previously reviewed guidance for conducting synoptic assessments of ecological condition. She stated that this guidance provided a good framework that outlined steps to be taken before completing an assessment. She noted that EPA should be funding additional work to develop GIS-based approaches for assessment. She noted that EPA should be more efficient in developing tools that can be used by the Agency's Regional Offices. Several panelists stated that there did not seem to be an Agency-wide approach to completing this important work.

Discussion of Charge Question 1.3

The Chair next asked the lead panel discussants to begin the discussion of charge question 1.3. (Appendix C). A panelist stated that several members of the Panel had expressed concern about whether the GISST criteria were measured on ordinal or cardinal scales. The Panel discussed the importance of ensuring that the measurements were appropriate for the mathematical operations used in the GISST. Panelists also discussed the issue of whether the scores of different criteria were comparable. It was suggested that it might be beneficial to keep impact and vulnerability scores separate. It was also suggested that a scale of 0-5 might be used to score the criteria.

A panelist noted that every project appeared to be evaluated differently. He therefore recommended that explicit definitions of the criteria be included in the GISST User's Manual. He noted that it was not possible to determine whether criteria scores were on the "upside" or "downside" of a slope, and that additional detail was needed in the criteria definitions. He further noted that interpretation of scores might depend on the kind of project evaluated (e.g., rainfall score might be assessed differently in a hog farm or power plant evaluation).

Another panelist stated that if criteria scores were on an interval scale they should not be added. He noted that such sums had no meaning. He further stated that interval scores should not be multiplied. Without additional information about the scales used, the scoring numbers do not have meaning. He stated that it was very important to clearly describe the scale of measurement used for the criteria scores.

A panelist stated that it was also important to consider the quality of data used in the analysis. She stated that metadata should be provided for the GISST criteria datasets. A panelist stated that good documentation of data sources was important, and EPA should also indicate whether data are missing. The panelist stated that there appeared to be some holes in the GISST datasets. She also noted that some of the data were "counts," and that it would be more desirable to use measurable data. She also stated that the rationale for assigning scores should be more clearly articulated. It was not clear how the GISST data binning process was done. She noted that sensitivity analysis would help show how the binning process might affect results. The process used in the GISST could be compared to other methods such as the use of quantiles.

A panelist stated that the choice of geographic unit used in the tool could also greatly affect the result of the evaluation. He stated that the hydrologic cataloging unit (HUC) was useful but HUC areas were quite variable, and that use of different HUCs could give different results. He stated that it was important to understand the ramifications of the choice of different geographic units. He also noted that statistical analyses could be conducted to evaluate covariance of the criteria. A panelist noted that EPA Region 6 had pulled together data that could be used in the GISST scoring system to provide an indication of some of the potential cumulative impact. However, he stated that there may be critical factors that would be lost when a cumulative score was derived. He stated that scores of individual variables might be more critical than a cumulative score.

Another panelist stated that she did not find the individual criteria scores to be problematic, but some of the criteria did not appear to be compatible for deriving a cumulative impact/vulnerability score. A panelist noted that there was no direct mention of carbon in the GISST assessment. He expressed the opinion that the carbon consequences of a project should be taken into consideration in an assessment. A number of panelists stated that they did not have objections to the GISST scoring system for individual criteria, but combining the criteria scores to assess cumulative impact presented problems.

Discussion of Charge Question 1.1

The Chair next called for discussion of charge question 1.1 (Appendix C). This discussion focused on the GISST algorithm.

A panelist described the algorithm and noted that it was straightforward. The panelist stated that the algorithm might be used for screening level evaluations but limitations must be considered. He noted that a geographic unit was not specified in the algorithm and that this introduced uncertainty because the use of different units would produce different results for similar analyses. He stated that some of the criteria underlying the cumulative score were specific and some were broad. It was not clear how users were to select criteria for use in the evaluation. A panelist stated that there appeared to be mathematical errors in the way the algorithm was written, it was not clear what was being summed in the algorithm.

Panelists noted that there should be some optional models provided for combining the criteria. Panelists stated that the watershed unit should not necessarily be used for analyses that did not focus on water quality. A number of panelists stated that there was merit in calculating a numerical index, but the numbers should not be used in a vacuum. The Panel discussed a number of concerns with the algorithm: the criteria used in the calculations were redundant and may conflict, the algorithm did not account for dynamics in the system (it is static taking snapshot one at a time). Panelists stated that EPA's Office of Research and Development should develop a national system that the EPA Regions could use.

Another panelist stated that an advantage of the GISST was its simplicity. However, he noted that it did not really provide a cumulative impact assessment. It allowed aggregation of a large amount of data in an initial screen. It had the potential to be useful, but his major concerns were that the criteria were not weighted, the system did not account for covariance, and ecological processes were not included. The panelist also noted that variables could be arbitrarily included in the analysis. The panelist suggested that EPA consider conducting sensitivity and goodness of fit analyses and looking at the metadata to select criteria for evaluations. The panelist reiterated the suggestion that the geographic unit used for GISST analyses should not be the watershed because it is not really a watershed-based tool.

A panelist expressed the opinion that it was not appropriate to use the algorithm for screening level decisions. Interpretation of the algorithm was problematic because rolling all of the individual impacts into a single number score did not appear to be appropriate. The panelist stated that the Interstate Highway 69 case study was the correct way to use the tool, but summing the impacts to obtain one number was problematic. The panelist also noted that describing the GISST score as an index of the “potential for significant environmental risk” was also problematic.

Another panelist expressed support for the use of a formula if the criteria could be appropriately weighted. He also stated that minimum/maximum thresholds should be used in the formula. A panelist pointed out that the GISST was to be used as a NEPA tool to illuminate potential environmental impacts. He stated that transparent evaluations were needed, and he noted that the score provided by the algorithm was not transparent. A panelist agreed that the final algorithm score should not be used without other information to evaluate project impacts. He stated that the power of GIS was that it provided the ability to look at data in many different ways. He noted that grouping data in different ways provided different results. Another panelist expressed the opinion that it was appropriate to use the algorithm if a clear description of the limitations were provided, but he noted that there may be better ways to look at the data. A panelist stated that the algorithm should not be discarded, but criteria weights should be applied. Another panelist expressed the opinion that a single summary number should not be used to make decisions. Individual data layers must be examined. Several other panelists agreed, stating that the summary score generated by the algorithm seemed to be inappropriate for use in decision making but it could be useful if explicit decision rules and criteria weights were formally incorporated into the evaluation process. Panelists recommended deemphasizing the formula and defining the bounds of how it should be used. Another panelist stated that if criteria numbers were on a ratio scale they could be added, but addition was not valid if the numbers were on an interval scale. A panelist also noted that impact and vulnerability should not be added.

At 12:15 p.m. the Chair stated that the Panel would recess for lunch and resume at 1:15 p.m. with discussion of charge question 2.1 and 2.2.

Discussion of Charge Questions 2.1 and 2.2

The Panel reconvened at 1:15 p.m. to discuss charge questions 2.1 and 2.2 (Appendix C). The Panel discussed the use of the GISST for prioritizing impacts for more detailed analysis. A Panelist stated that the use of single combined scores should be avoided. The panelist stated that the GISST User's Manual did not clearly indicate how the tool would be used for prioritization, nor did it indicate how the tool would be used for screening. The panelist noted that all 70 GISST criteria might be part of a scoping review, but this was not clearly addressed in the GISST documentation. He stated that the process used to derive cumulative scores needed to be clearly defined so that applicants could evaluate data in advance of a decision.

Another panelist discussed limitations associated with using HUCs for GISST evaluations. He noted that HUCs were not watersheds. HUCs could be part of several watersheds. The panelist stated that an appropriate ecological unit must be evaluated in order to illuminate potential environmental impacts. He also noted that the 1km² unit used in the Interstate Highway 69 case study might not be meaningful. Panelists also stated that it was important to define the objectives of an evaluation before it was completed.

A panelist stated that he had some difficulty separating charge question 2.1 (focusing on the use of the GISST for prioritizing impacts) and charge question 2.2 (focusing on evaluating project alternatives). He expressed the opinion that because the GISST criteria were not weighted, the GISST was not adequate for prioritizing impacts. He stated that it was not clear that the criteria represented the values of decision makers. He noted that it was not possible to consider effects without considering goals and objectives. He stated that development of the GISST criteria should follow problem formulation. He also noted that the 1-5 GISST criteria scores were used in heterogeneous regions and therefore might not reflect impacts for an entire region. He noted that single impacts may be inaccurately represented because in some cases the data used in GISST evaluations were imprecise. Another panelist stated that the mapping classes used in the GISST should be carefully selected, and that the process used to select them should be transparent. He noted that computer generated output required documentation.

The Panel discussed charge question 2.2. A panelist stated that the GISST did not appear to provide the range of information needed by decision makers to evaluate project alternatives. He stated that decision makers would need to know whether a project has potential environmental impact and the advantages of one particular project over another. Decision makers would also require information that could be used to design new alternatives. He stated that the GISST summary score did not provide information on specific project impacts and the spatial dependence of cells was not considered in GISST evaluations. He noted that it would be necessary for decision makers to examine individual criteria scores to see why a project had an impact. In addition, he stated that the GISST could not be used to simultaneously view two projects and compare the advantages and disadvantages of each. A panelist stated that the GISST would not provide information about the pros and cons of each alternative project.

Another panelist agreed with the previous statements but noted that GIS could be helpful in evaluating project alternatives and recommended that EPA take advantage of Boolean decision support tools that could be used to evaluate alternatives. Another panelist noted that the Interstate Highway 69 case study was an excellent example of how the GISST could be used to help inform decisions. A panelist asked EPA staff to describe the kind of information that would be given to decision makers if the GISST were not available. EPA staff responded that decision makers would not have as much information to make decisions.

A panelist stated that EPA might want to consider using an ecoregions approach in conducting GISST evaluations. Several examples such as ecotypes of Alaska were mentioned. The panelist noted that EPA needed to use a survey tool that was based on reasonable ecological units. The panelist stated that some augmentation of the GISST with digital data representing ecological units would be helpful.

Another panelist agreed that GIS could be a useful tool to inform decision making, but he expressed the opinion that the GISST should not be used to make decisions unless a linkage is provided between what is measured and what people care about. He stated that decision makers also needed to know how the tool works. The Chair noted that other panelists had expressed this concern and that there was a pressing need for GIS-based decision support tools. She further stated that such tools were not available, and it would be helpful to tell EPA that additional support for development of these tools was critically important. Another panelist agreed that alternatives to the GISST might not be available but he stated that the GISST could only provide a coarse analysis and its limitations should be recognized and addressed.

At 3:30 p.m. the Chair recessed the Panel for a break and stated that the Panel would reconvene at 3:45 to discuss charge question 3.1.

Discussion of Charge Question 3.1

At 3:45 p.m. the Panel reconvened and deliberated on charge question 3.1 (Appendix C). The Panel discussed a number of improvements to enhance the GISST User's Manual. A panelist stated that more detailed definitions of the criteria should be included in the User's Manual. Another panelist noted that the rationale for the GISST scoring system should be more clearly articulated and data sources should be clearly identified. Metadata should be provided. Other panelists discussed the following enhancements to the User's Manual:

- The Manual should clearly describe how criteria were selected for use in different projects;
- Guidance should be provided for interpreting GISST output;
- A better definition of the GISST itself should be provided;
- The use of socioeconomic vs. ecological criteria should be discussed;
- Additional information on the need for (and use of) GISST in the NEPA process should be provided;

- More transparency was needed in the description of how the tool works;
- A more thorough discussion of the drawbacks associated with the GISST approach to integrating criteria was needed (the document should also provide suggested approaches to addressing these drawbacks);
- More information was needed to document how stakeholders had been and will be involved in GISST evaluations;
- The definitions, assumptions, limitations, and uncertainties associated with the GISST needed to be expanded and more clearly articulated.

A panelist noted that every chapter in the GISST User's Manual appeared to have been written for a different audience. The panelist stated that different documents were probably needed for these audiences. Another panelist stated that the entire User's Manual and figures should be available in a single file for downloading and printing from the GISST website.

A panelist stated that a conceptual model underlying the GISST should be described and that the document would be easier to understand if the criteria were organized and presented hierarchically. The panelist also stated that more examples describing the use of the GISST should be included in the User's Manual. Another panelist noted that the User's Manual should clearly state what makes the GISST different from other GIS tools. Panelists also discussed a number of editorial changes needed in the User's Manual. It was recommended that a technical editor review the next iteration of the document.

At 5:00 p.m. the Chair thanked the Panel and EPA staff for participating in the discussion, stated that the Panel would reconvene at 8:30 a.m. the next morning to begin drafting the Panel's report, and recessed the Panel for the day.

December 8, 2005

The Chair convened the Panel meeting at 8:30 a.m. and stated that during the morning there would be a writing session to begin developing the draft report. The Chair described the structure of the report. She noted that the Panel would try to reach consensus on all points included in the report but if there were points of disagreement they would be discussed in the document. A panelist stated that the report should recommend that EPA support the development of GIS-based tools that could be used by Agency program offices and Regions. The panelist stated that the piecemeal development of such tools was not efficient. The Chair responded that key recommendations should be included in the cover letter to the EPA Administrator and the executive summary of the report.

The panel held a writing session from 9:00 a.m. to 10:30 a.m. to develop sections of the report responding to the charge questions. Lead discussants for each charge question worked to develop the responses.

At 10:30 a.m. the Chair asked the lead discussants to review the key points to be included in the report.

Summary Discussion of Key Points in Response to the Charge Questions

Question 1.2

Lead discussants summarized the key points in the response to charge question 1.2, and the points were discussed by the Panel. A panelist asked that the report contain discussion of different kinds of vulnerability represented by the GISST criteria. She also noted that it was not possible to state whether the criteria were relevant without knowing project objectives. A number of panelists agreed that the report should discuss types of vulnerability, and the importance of defining types of impact to be measured. A number of panelists agreed that the report should recommend that EPA develop criteria selection templates for different types of projects (e.g., CAFOS, power plants, etc.).

Question 1.3

Lead discussants summarized key points in the response to charge question 1.3, and the points were discussed by the Panel. A panelist asked whether a recommended definition of the GISST should be provided in the response to charge question 1.3. A number of panelists expressed the opinion that the GISST should be described at the beginning of the report.

Question 1.1

Lead discussants summarized key points to be included in the response to charge question 1.3, and the points were discussed by the Panel. Several panelists stated that the report should emphasize the need for additional statistical analysis. A number of panelists agreed that the strength of the GISST was in the individual data layers and that the cumulative score should be deemphasized. Panelists reiterated problems associated with combining the GISST criteria and using the GISST algorithm to develop a summary score. Panelists stated that the GISST developers should be cautioned to consider limitations of the tool when it is used.

Questions 2.1 and 2.2

Lead discussants summarized key points to be included in the response to charge questions 2.1 and 2.2, and the points were discussed by the Panel. A number of concerns associated with the use of the GISST for priority setting were discussed, and the Panel agreed to include them in the report. The Panel discussed information that decision makers needed to evaluate project alternatives. A number of panelists noted that the all of this information could not be provided by the GISST and that this should be stressed in the report.

Question 3.1

Lead discussants summarized key points to be included in the response to charge question 3.1, and the points were discussed by the Panel. Recommended editorial changes in the GISST User's Manual were discussed, and the Chair noted that these should be included in an appendix to the Panel's report.

The Chair thanked the panelists for their work to develop responses to the charge questions and asked that all of the written material be provided to the DFO for incorporation into the draft report. She stated that the draft report would be sent to the Panel for review when it was completed, and that a public teleconference would be scheduled to discuss the report.

Discussion of the Upcoming SAB Ecological Risk Assessment Workshop

The Chair stated that the last item on the agenda was discussion of the upcoming SAB Ecological Risk Assessment Workshop. She noted that the workshop would be held on February 7-8 in Washington, D.C. The draft workshop agenda and a list of workshop invitees were distributed to the Panel. The Chair reviewed expectations for the workshop, reviewed the agenda, and answered questions from Ecological Processes and Effects Committee Members who would be attending.

At 1:00 p.m. the Chair concluded the discussion of the Ecological Risk Assessment Workshop, again thanked the Panel for their work, and adjourned the meeting.

Respectfully Submitted:

Certified as True:

/Signed/

/Signed/

Dr. Thomas M. Armitage
Designated Federal Officer

Dr. Virginia Dale
Panel Chair

APPENDICES

Appendix A: Roster of SAB Geographic Information System Screening Tool Review Panel

Appendix B: Meeting Agenda

Appendix C: Charge Questions to the Panel

Appendix D: EPA Region 6 Presentations

Appendix A – Panel Roster

U.S. Environmental Protection Agency Science Advisory Board Ecological Processes and Effects Committee Geographic Information System Screening Tool Review Panel

CHAIR

Dr. Virginia Dale, Corporate Fellow, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN

MEMBERS

Mr. DeWitt Braud, Director, Academic Area, Coastal Studies Institute, Louisiana State University, Baton Rouge, LA

Dr. Ivan J. Fernandez, Professor, Department of Plant, Soil and Environmental Sciences, University of Maine, Orono, ME

Dr. Carol Johnston, Professor, Center for Biocomplexity Studies, South Dakota State University, Brookings, SD

Dr. William Mitsch, Professor, Olentangy River Wetland Research Park, The Ohio State University, Columbus, OH

Dr. Thomas C. Mueller, Professor, Department of Plant Sciences, University of Tennessee, Knoxville, TN

Dr. Michael C. Newman, Professor of Marine Science, School of Marine Sciences, Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA

Dr. James Oris, Professor, Department of Zoology, Miami University, Oxford, OH

Dr. Charles Rabeni, Leader, Missouri Cooperative Fish and Wildlife Research Unit, U.S. Geological Survey, Columbia, MO

Dr. Mark Ridgley, Professor and Chair, Department of Geography, University of Hawaii at Manoa, Honolulu, HI

Dr. Amanda Rodewald, Assistant Professor, School of Natural Resources, The Ohio State University, Columbus, OH

Dr. James Sanders, Director, Skidaway Institute of Oceanography, Savannah, GA

Dr. David Stoms, Associate Researcher, Institute for Computational Earth Systems Science, University of California at Santa Barbara, Santa Barbara, CA

Mr. Timothy Thompson, Senior Environmental Scientist, Science, Engineering, and the Environment, LLC, Seattle, WA

Dr. Robert Twiss, Professor, The Graduate School, University of California-Berkeley, Ross, CA

SCIENCE ADVISORY BOARD STAFF

Dr. Thomas Armitage, Designated Federal Officer, U.S. Environmental Protection Agency, Washington, D.C.

Appendix B – Meeting Agenda

**U.S. EPA SCIENCE ADVISORY BOARD
Ecological Processes and Effects Committee
Geographic Information System Screening Tool Review Panel
EPA Region 6 Conference Center – Oklahoma Room
U.S. EPA Region 6 Office, 12th Floor, Fountain Place
1445 Ross Avenue, Dallas, Texas 75202-2733**

December 7-8, Public

I. Review of the Geographic Information System Screening Tool (GISST)

Wednesday, December 7, 2005

- 8:30 - 8:40 a.m. **Meeting Convened by the Designated Federal Officer**
Dr. Thomas Armitage
EPA Science Advisory Board Staff Office
- 8:40 – 8:55 a.m. **Welcome and Introductory Remarks**
Dr. Anthony Maciorowski, Associate Director for Science
EPA Science Advisory Board Staff Office

EPA Region 6 Representatives
- 8:55 - 9:10 a.m. **Purpose of the Meeting and Review of the Agenda**
Dr. Virginia Dale, Chair
- 9:10 – 10:10 a.m. **Overview of the GISST Framework, Methodology, and Uses**
Dr. Sharon Osowski, U.S. EPA Region 6
- 10:10 – 10:25 a.m. BREAK
- 10:25 – 11:00 a.m. **Case Study: Application of GISST in Decision-Making**
Dr. Sharon Osowski, U.S. EPA Region 6
- 11:00 – 11:10 a.m. **Public Comments**
- 11:10 – 12:15 p.m. **Panel Discussion of Charge Question 1 - GISST Methodology
and Framework**
Dr. Virginia Dale and Panel

Charge Question 1.1: The GISST mathematical algorithm (presented in Chapter 3 of the GISST User’s Manual) for determining the “potential for significant environmental risk” of projects is a multiplicative formula using the watershed as the base unit. Please comment on the reasonableness and appropriateness of using this algorithm for conducting screening level evaluations as described in the GISST User’s Manual.

In the Interstate Highway 69 case study, the GISST algorithm was not used because it was not beneficial to obtain one cumulative vulnerability score for the entire highway corridor. Instead, vulnerability within the corridor was evaluated by summing the scores of vulnerability criteria within 1 km² areas in a grid system. Please comment on the reasonableness and appropriateness of this method for conducting an initial screening level evaluation.

Charge Question 1.2: Appendix A of the GISST User’s Manual identifies the impact and vulnerability criteria that are used in the GISST to evaluate environmental impact and vulnerability. A subset¹ of these criteria is frequently used by EPA Region 6 to conduct GISST evaluations. Are the criteria in this subset reasonable and appropriate for use in GISST evaluations of the potential degree of vulnerability of a project area and the potential degree of impact produced by a proposed project? Please provide similar comments for the other criteria in Appendix A. Are there additional categories of criteria that should be developed for use in GISST evaluations?

Charge Question 1.3: The GISST uses data sets (in Appendix A) with different coverages generated for different purposes (e.g., point sampling of water quality, census data, and land cover data gathered by satellite). Is the GISST 1 – 5 scoring scale on these coverages and datasets reasonable for developing an initial assessment of the potential cumulative impacts of proposed projects.

12:15 – 1:15 p.m LUNCH

¹ The subset of criteria most frequently used in GISST evaluations includes: Stream Density (surface water quantity), Population Density, Minority (environmental justice), Economic (environmental justice), Agricultural Lands, Density of Managed Lands, Hazardous Waste (Other Industries or Pollution Sources), Impaired Stream Segments (Clean Water Act 303(d) Segments), Wetlands, Floodplain, Ozone Nonattainment, Texas Ecological Assessment Protocol (TEAP) Diversity, TEAP Rarity, TEAP Sustainability, TEAP Composite, Wildlife Habitat, Federally-listed Species, and State-listed Species, and Ecologically Significant Stream Segments. The TEAP criteria were derived using a tool developed by EPA Region 5, the Critical Ecosystem Assessment Model (CREAM). The SAB has reviewed the CREAM. The SAB report on the CREAM is available at: http://www.epa.gov/sab/pdf/cream_sab-05-011.pdf

1:15 – 2:15 p.m. **Panel Discussion of Charge Question 1 - GISST Methodology and Framework (continued)**

2:15 – 3:30 p.m. **Panel Discussion of Charge Question 2 - Application of the GISST to Environmental Decision-Making**
Dr. Virginia Dale and Panel

Charge Question 2.1: EPA intends to use the GISST in the NEPA process as an initial screening tool to prioritize potential single, direct, and cumulative environmental impacts of projects for more detailed analyses. Please comment on the strengths and limitations of the GISST as it applies to this purpose.

Charge Question 2.2: EPA also intends to use the GISST in the NEPA process to evaluate environmental impacts of project alternatives to help inform decision-making. Please comment on the usefulness of the GISST as a tool for this use.

3:30 – 3:45 p.m. BREAK

3:45 – 4:45 p.m. **Panel Discussion of Charge Question 3 – GISST Documentation**
Dr. Virginia Dale and Panel

Charge Question 3.1: Please provide recommendations on steps that can be taken to enhance the usability of the GISST User’s manual and documentation.

4:45 – 5:00 p.m. **Summary of Day One Discussion and Expectations for the Following Day**
Dr. Virginia Dale and Panel

5:00 p.m. **RECESS FOR THE DAY**

Thursday, December 8, 2005

8:30 – 10:30 a.m. **Writing Session to Develop Responses to Charge Questions**

10:30 – 11:45 a.m. **Review of Draft Responses to the Charge Questions**
Dr. Virginia Dale and Panel

11:45 – 12:00 p.m. **Summary of GISST Discussion and Next Steps**
Dr. Virginia Dale

II. Other Ecological Processes and Effects Committee Business

12:00 – 1:00 p.m. **Discussion of Upcoming SAB Ecological Risk Assessment
Workshop**

Dr. Virginia Dale and Panel

1:00 p.m. **ADJOURN MEETING**

Appendix C – Charge Questions to the Panel

Region 6 GIS Screening Tool (GISST) Methodology and User's Manual

Charge to the SAB Review Panel

Background

U.S. EPA Region 6 has developed a Geographic Information System Screening Tool (GISST) for use in evaluating the potential *environmental impacts* of large complex Federal projects such as the construction of roads, the permitting of water treatment plants, and timber sales on Federal properties. The GISST can also be used to evaluate the potential *environmental vulnerability* of the proposed locations of such projects. The GISST is a descriptive tool used to facilitate decision-making by enabling visualization (in a geographic information system) of data layers that provide an initial level of representation of the potential impacts of projects, and the potential vulnerability of alternative project sites. The GISST is not a predictive model. It does not provide modeled outputs reflecting the ecological effects of proposed activities.

The GISST was developed by EPA Region 6 for use in preparing and reviewing environmental assessments and impact statements required under the National Environmental Policy Act (NEPA). NEPA requires that federal agencies prepare environmental assessments or impact statements for major actions (including the issuance of permits) affecting the environment. In addition to preparing assessments and impact statements for its own actions, EPA must also review the environmental assessments and impact statements of other federal agencies. The NEPA process requires the evaluation of potential direct, indirect, single and cumulative impacts associated with projects and project alternatives. The GISST has greatly enhanced the ability of EPA staff to systematically visualize potential project impacts and their cumulative effects on the environment. It has also provided a tool for evaluating and prioritizing project alternatives in order to make decisions.

GISST users can determine the potential environmental impacts of projects and the environmental vulnerabilities of project locations by evaluating sets of geographically referenced data. These data sets represent selected vulnerability and impact “criteria” in a number of different categories (e.g., ecological, socioeconomic, toxicity, water quality, air quality). For example, in the GISST, rainfall at a project location is evaluated as a vulnerability criterion because a greater amount of rainfall can be associated with greater infiltration to groundwater and runoff to surface water. The density of federally managed lands at a project location is evaluated as an impact criterion because greater project impacts are anticipated in areas with more federally managed lands. Some GISST criteria are both impact and vulnerability criteria. To facilitate decision-making, a scoring system with a scale of one to five is used in the GISST to evaluate the data sets

associated with each criterion. A score of one equals a lower level of potential impact or vulnerability, and a score of five equals a higher level of potential impact or vulnerability. Values used to rate the data representing each criterion have been assigned by EPA using professional judgment (see Appendix A of the GISST User's Manual). In the GISST, the degree of potential vulnerability of a watershed subunit, project area, or other appropriate geographical unit is defined as the average or the sum of the vulnerability criteria scores. The degree of potential impact produced by a project is defined as the average or sum of the impact criteria scores within a geographic unit. A mathematical algorithm (in Chapter 3 of the GISST User's Manual) is also used in the GISST to derive the "potential for significant environmental risk" associated with projects. This algorithm considers the ratio of the cumulative area affected by a project to the total area evaluated, the degree of potential vulnerability of the area evaluated, and the degree of potential impact produced by the project. The results of GISST analyses can be displayed on maps that include data overlays generated using different criteria.

EPA Region 6 is seeking comment from the Science Advisory Board on: 1) whether the GISST methodology is reasonable and appropriate for use in conducting initial level assessments of potential environmental impacts and vulnerability, 2) the strengths and limitations of the GISST as a tool for use in prioritizing and comparing environmental vulnerabilities and impacts for decision-making, and 3) steps that can be taken to further develop the GISST User's manual and documentation. Specifically, EPA Region 6 is seeking advice regarding the following questions.

EPA Region 6 has provided the following material to the Panel for review:

- The GISST User's Manual

The GISST User's Manual contains: 1) An introduction in question and answer format that describes the uses of the GISST; 2) Background information on concepts underlying the GISST; 3) Information on development of the GISST algorithm and criteria; 4) A series of case studies where the GISST has been applied, including an illustrative case study describing the use of the GISST to assess the environmental impacts associated with the construction of Interstate Highway 69 in Texas; 5) The finalized GISST criteria; 6) Additional GISST criteria that are under development; 7) The GIS Programming language used in the GISST; and 8) a Peer Review History of GISST.

Charge Questions to the Panel

Question 1. GISST Methodology

- 1.1 The GISST mathematical algorithm (presented in Chapter 3 of the GISST User's Manual) for determining the "potential for significant environmental risk" of projects is a multiplicative formula using the watershed as the base unit. Please comment on the reasonableness and appropriateness of using this algorithm for conducting screening level evaluations as described in the GISST User's Manual.

In the Interstate Highway 69 case study, the GISST algorithm was not used because it was not beneficial to obtain one cumulative vulnerability score for the entire highway corridor. Instead, vulnerability within the corridor was evaluated by summing the scores of vulnerability criteria within 1 km² areas in a grid system. Please comment on the reasonableness and appropriateness of this method for conducting an initial screening level evaluation.

- 1.2 Appendix A of the GISST User's Manual identifies the impact and vulnerability criteria that are used in the GISST to evaluate environmental impact and vulnerability. A subset² of these criteria is frequently used by EPA Region 6 to conduct GISST evaluations. Are the criteria in this subset reasonable and appropriate for use in GISST evaluations of the potential degree of vulnerability of a project area and the potential degree of impact produced by a proposed project? Please provide similar comments for the other criteria in Appendix A. Are there additional categories of criteria that should be developed for use in GISST evaluations?
- 1.3 The GISST uses data sets (in Appendix A) with different coverages generated for different purposes (e.g., point sampling of water quality, census data, and land cover data gathered by satellite). Is the GISST 1 – 5 scoring scale on these coverages and datasets reasonable for developing an initial assessment of the potential cumulative impacts of proposed projects?

Question 2. Application of the GISST to Environmental Decision-Making

- 2.1 EPA intends to use the GISST in the NEPA process as an initial screening tool to prioritize potential single, direct, and cumulative environmental impacts of projects for more detailed analyses. Please comment on the strengths and limitations of the GISST as it applies to this purpose.
- 2.2 EPA also intends to use the GISST in the NEPA process to evaluate environmental impacts of project alternatives to help inform decision-making. Please comment on the usefulness of the GISST as a tool for this use.

² The subset of criteria most frequently used in GISST evaluations includes: Stream Density (surface water quantity), Population Density, Minority (environmental justice), Economic (environmental justice), Agricultural Lands, Density of Managed Lands, Hazardous Waste (Other Industries or Pollution Sources), Impaired Stream Segments (Clean Water Act 303(d) Segments), Wetlands, Floodplain, Ozone Nonattainment, Texas Ecological Assessment Protocol (TEAP) Diversity, TEAP Rarity, TEAP Sustainability, TEAP Composite, Wildlife Habitat, Federally-listed Species, and State-listed Species, and Ecologically Significant Stream Segments. The TEAP criteria were derived using a tool developed by EPA Region 5, the Critical Ecosystem Assessment Model (CREAM). The SAB has reviewed the CREAM. The SAB report on the CREAM is available at: http://www.epa.gov/sab/pdf/cream_sab-05-011.pdf

Question 3. GISST Documentation

- 3.1 Please provide recommendations on steps that can be taken to enhance the usability of the GISST User's manual and documentation.

Appendix D – EPA Region 6 Presentations

EPA Region 6 GIS Screening Tool for Environmental Assessment (GISST)



Sharon L. Osowski, Ph.D.
Ecologist
EPA Region 6

R6 Office of Planning & Coordination
WHAT IS IT?

Environmental assessment tool

Screening-level tool 

Uses GIS coverages & databases

Scoring structure imposed on data

R6 Office of Planning & Coordination
EPA Context

Necessity

Time-critical activities

Improving the status quo

R6 Office of Planning & Coordination
Charge: Methodology

Appendix A of the GISST User's Manual describes the input and vulnerability criteria that are used in the GISST to evaluate environmental impact and vulnerability. A subset (1) of these criteria is specifically used by EPA Region 6 to conduct GISST evaluations. Are the criteria in this report reasonable and appropriate for use in GISST evaluation of the potential degree of vulnerability of a project area and the potential degree of impact resulting from a proposed project? Please provide a brief response for the other criteria in Appendix A. Are there additional categories of criteria that should be developed for use in GISST evaluation?

1) Includes: 1) Air Quality Criteria, 2) Air Quality Standards, 3) Air Quality Criteria, 4) Air Quality Standards, 5) Air Quality Criteria, 6) Air Quality Standards, 7) Air Quality Criteria, 8) Air Quality Standards, 9) Air Quality Criteria, 10) Air Quality Standards, 11) Air Quality Criteria, 12) Air Quality Standards, 13) Air Quality Criteria, 14) Air Quality Standards, 15) Air Quality Criteria, 16) Air Quality Standards, 17) Air Quality Criteria, 18) Air Quality Standards, 19) Air Quality Criteria, 20) Air Quality Standards, 21) Air Quality Criteria, 22) Air Quality Standards, 23) Air Quality Criteria, 24) Air Quality Standards, 25) Air Quality Criteria, 26) Air Quality Standards, 27) Air Quality Criteria, 28) Air Quality Standards, 29) Air Quality Criteria, 30) Air Quality Standards, 31) Air Quality Criteria, 32) Air Quality Standards, 33) Air Quality Criteria, 34) Air Quality Standards, 35) Air Quality Criteria, 36) Air Quality Standards, 37) Air Quality Criteria, 38) Air Quality Standards, 39) Air Quality Criteria, 40) Air Quality Standards, 41) Air Quality Criteria, 42) Air Quality Standards, 43) Air Quality Criteria, 44) Air Quality Standards, 45) Air Quality Criteria, 46) Air Quality Standards, 47) Air Quality Criteria, 48) Air Quality Standards, 49) Air Quality Criteria, 50) Air Quality Standards, 51) Air Quality Criteria, 52) Air Quality Standards, 53) Air Quality Criteria, 54) Air Quality Standards, 55) Air Quality Criteria, 56) Air Quality Standards, 57) Air Quality Criteria, 58) Air Quality Standards, 59) Air Quality Criteria, 60) Air Quality Standards, 61) Air Quality Criteria, 62) Air Quality Standards, 63) Air Quality Criteria, 64) Air Quality Standards, 65) Air Quality Criteria, 66) Air Quality Standards, 67) Air Quality Criteria, 68) Air Quality Standards, 69) Air Quality Criteria, 70) Air Quality Standards, 71) Air Quality Criteria, 72) Air Quality Standards, 73) Air Quality Criteria, 74) Air Quality Standards, 75) Air Quality Criteria, 76) Air Quality Standards, 77) Air Quality Criteria, 78) Air Quality Standards, 79) Air Quality Criteria, 80) Air Quality Standards, 81) Air Quality Criteria, 82) Air Quality Standards, 83) Air Quality Criteria, 84) Air Quality Standards, 85) Air Quality Criteria, 86) Air Quality Standards, 87) Air Quality Criteria, 88) Air Quality Standards, 89) Air Quality Criteria, 90) Air Quality Standards, 91) Air Quality Criteria, 92) Air Quality Standards, 93) Air Quality Criteria, 94) Air Quality Standards, 95) Air Quality Criteria, 96) Air Quality Standards, 97) Air Quality Criteria, 98) Air Quality Standards, 99) Air Quality Criteria, 100) Air Quality Standards.

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Question 1.2

Are each of the following criteria reasonable and appropriate to evaluate the issue at a screening or initial level of assessment?

R6 Office of Planning & Coordination
Criterion Development Process

Why only these 19 criteria?

- Used most frequently and important on most projects
- Incorporate many of the traditional NEPA concerns
- Are included in the ArcGIS toolbar
- Will be incorporated into Web-based NEPAassist tool
- Other criteria can be used, but not "automated"
- Most people can only mentally process <20 criteria

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Population Density

persons/mi ²	Score
0	1
1-200	2
201-1000	3
1001-5000	4
>5000	5

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Minority

% Minority	Score
≤ state avg	1
State avg to 1.33x state avg	2
1.34x state avg to 1.66x state avg	3
1.67x state avg to 1.99x state avg	4
≥ 2x state avg	5

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Economically-stressed

% economically stressed	Score
≤ state avg	1
State avg to 1.33x state avg	2
1.34x state avg to 1.66x state avg	3
1.67x state avg to 1.99x state avg	4
≥ 2x state avg	5

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Agricultural lands

% of area	Score
< 20 %	1
20-29%	2
30-39%	3
40-49%	4
≥ 50%	5

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Managed Lands

Presence in area	Score
No	1
Yes	5

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Hazardous Waste

Number w/in 2 mi buffer	Score
0 industries or land areas	1
1 industries or land areas	2
2 industries or land areas	3
3 industries or land areas	4
≥ 4 industries or land areas	5

 **R6 Office of Planning & Coordination**
Stream Density

mi/mi ² shore or stream length	Score
< 0.917	1
0.917-1.15	2
1.16-1.43	3
1.44-1.7	4
> 1.7	5

 **R6 Office of Planning & Coordination**
Impaired Waters

Presence in area	Score
No	1
Yes	5

 **R6 Office of Planning & Coordination**
Wetlands

% of area	Score
< 20 %	1
20-29%	2
30-39%	3
40-49%	4
≥ 50%	5

 **R6 Office of Planning & Coordination**
Floodplains

% of area	Score
No data	0
< 20 %	1
20-29%	2
30-39%	3
40-49%	4
≥ 50%	5

 **R6 Office of Planning & Coordination**
Ozone Nonattainment

Project Location	Score
outside nonattainment area	1
near nonattainment area	3
inside nonattainment area	5

 **R6 Office of Planning & Coordination**
Wildlife Habitat

% of area	Score
< 20 %	1
20-29%	2
30-39%	3
40-49%	4
≥ 50%	5

 **R6 Office of Planning & Coordination**
Federally listed Species

Presence in area	Score
No	1
Yes	5

 **R6 Office of Planning & Coordination**
State listed Species

Presence in area	Score
No	1
Yes	5

 **R6 Office of Planning & Coordination**
Ecologically Significant Streams

Presence in area	Score
No	1
Yes	5

 **R6 Office of Planning & Coordination**
IH69 Criteria Replacement

The following criteria were replaced by TEAP information:

- Wildlife Habitat
- Federally-listed Species
- State-listed Species
- Ecologically Significant Streams

Note: TEAP information exists only for Texas, other R6 states must continue to use these criteria

 **R6 Office of Planning & Coordination**
Charge: Methodology

The GISST uses data sets (in Appendix A) with different coverages generated for different purposes (e.g. point sampling of water quality, census data, and land cover data gathered by satellite). Is the GISST 1–5 scoring scale on these coverages and datasets reasonable for developing an initial assessment of the potential cumulative impacts of proposed projects?

 **R6 Office of Planning & Coordination**
Question 1.3

•How does Region 6 develop criteria?



R6 Office of Planning & Coordination
Criterion Development Process

- Criteria are developed as needed
 - Available data
 - Program (staff & mgmt) interest
 - Others
- Total Number of Criteria (Final and Provisional) ~ 100



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Criterion Development Process

- Who is involved? In general...
 - staff desiring the criteria
 - internal experts on a particular subject to determine whether the scoring is reasonable
 - GISST developers who locate available data and put the criterion together
 - can be difficult



R6 Office of Planning & Coordination
Criterion Development Process

- Why 1-5 scoring?
 - Concept is easily grasped (ABCDF)
 - Contrast on maps is easy to discern
 - Contrast between ranks gives one a better sense of its meaning
 - i.e., the difference between 1 and 2 on a 5 pt system is easier to understand than a 1 and 2 on a 10 pts system



R6 Office of Planning & Coordination
Criterion Development Process

- How do we determine the 1 to 5 scoring?
 - Analyze data for natural breaks
 - Regulatory thresholds
 - Policy objectives or initiatives
 - Other references as described
 - Expert Opinion
 - Definitions, limitations, assumptions are discussed and documented



R6 Office of Planning & Coordination
Criterion Development Process

- Use of datasets
 - No time/money to collect "new" data
 - Must use readily available electronic data that has some level of QA/QC
 - Datasets collected for different purposes
 - Try to match data and criteria to the best extent, i.e., some data may represent a surrogate for a pattern or process for which data does not exist
 - e.g., land cover might be a surrogate for endangered species if locations are not known



R6 Office of Planning & Coordination
Charge: Methodology

The GISST mathematical algorithm (presented in Chapter 3 of the GISST User's Manual) for determining the "potential for significant environmental risk" of projects is a multiplicative formula using the watershed as the base unit. Please comment on the reasonableness and appropriateness of using this algorithm for conducting screening-level evaluations as described in the GISST User's Manual.

In the Interstate Highway 69 case study, the GISST algorithm was not used because it was not beneficial to obtain one cumulative vulnerability score for the entire highway corridor. Instead, vulnerability within the corridor was evaluated by summing the scores of vulnerability criteria within 1 km² areas in a grid system. Please comment on the reasonableness and appropriateness of this method for conducting an initial screening level evaluation.

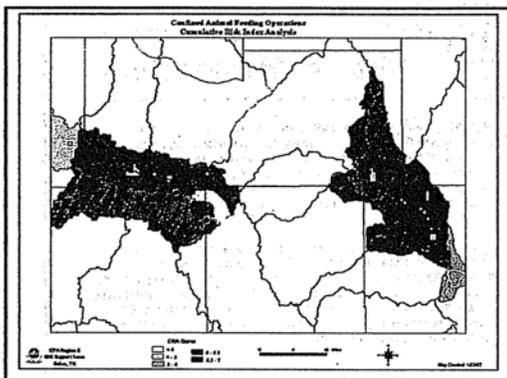
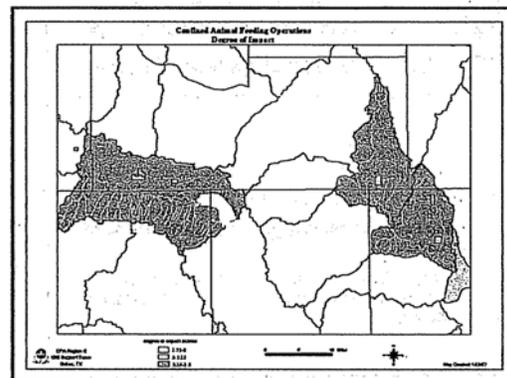
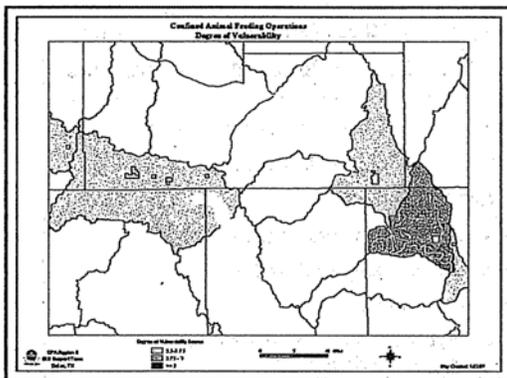
R6 Office of Planning & Coordination
Question 1.1

•Is the mathematical formula and/or other methods (e.g., IH69 grid) reasonable and appropriate to calculate a cumulative score at a screening or initial level of assessment?

R6 Office of Planning & Coordination
Charge: Methodology

Original Formula:
 $GISST = \sum (A_i/A_{WS}) \times D_v \times D_i$

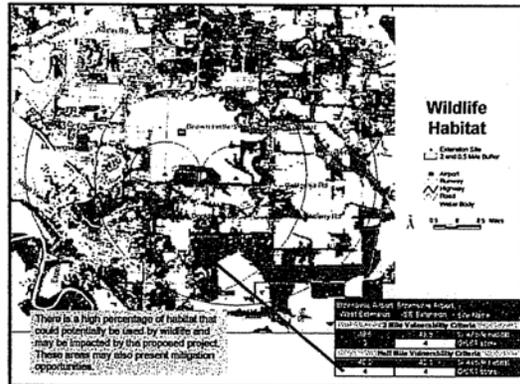
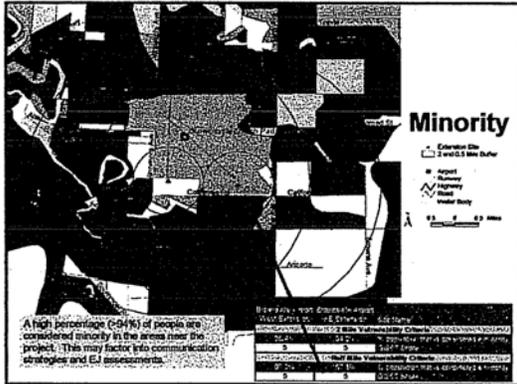
A = total area of known project
 A_{WS} = area of watershed unit
 D_v = average of vuln criteria for watershed unit
 D_i = average of impact criteria produced by the project



R6 Office of Planning & Coordination
Charge: Methodology

Other Calculation

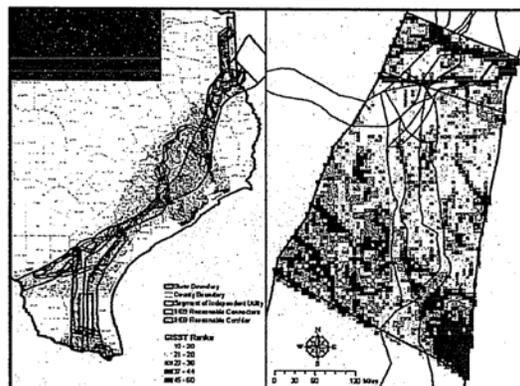
- GISST Criteria scores are calculated for 0.5 and 2 mile buffers around project
- Example: NEPA Scoping Process



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Charge: Methodology

IH69 Calculation:

- Uses a 1km² grid system
- No separation of vulnerability and impact criteria
- No multiplicative formula, straight summation of criterion scores



R6 Office of Planning & Coordination
Charge: Application

EPA intends to use the GISST in the NEPA process as an initial screening tool to prioritize potential single, direct, and cumulative environmental impacts of projects for more detailed analyses. Please comment on the strengths and limitations of the GISST as it applies to this purpose.

EPA also intends to use the GISST in the NEPA process to evaluate environmental impacts of project alternatives to help inform decision-making. Please comment on the usefulness of the GISST as a tool for this use.

R6 Office of Planning & Coordination
Charge: Application

Is it reasonable and appropriate to use GISST as a way (initial screen) to prioritize potential impacts for further analysis within NEPA?

Is it reasonable and appropriate to use GISST as a way of evaluating and prioritizing alternatives and is it ok to use this information in decision making?

 **R6 Office of Planning & Coordination**
Charge: Application

Is it reasonable and appropriate to use GISST as a way (initial screen) to prioritize potential impacts for further analysis within NEPA?

Example: NEPA Scoping

 **R6 Office of Planning & Coordination**
Charge: Application

Is it reasonable and appropriate to use GISST as a way of evaluating and prioritizing alternatives and is it ok to use this information in decision making?

Examples: CAFOs, IH69

 **R6 Office of Planning & Coordination**
Charge: Documentation

Please provide recommendations on steps that can be taken to enhance the usability of the GISST User's manual and documentation.

 **R6 Office of Planning & Coordination**
Charge: Documentation

Can one figure out what Region 6 did to develop GISST and can others replicate it based on the User's Manual?

 **R6 Office of Planning & Coordination**
Charge: Enhancements

What can Region 6 do to improve GISST?

Validation
 Weighting
 Sensitivity Analysis

 **R6 Office of Planning & Coordination**
Enhancements: Region 6 plans

Validation
 RRPP (now defunct)
 RARE Grant proposal

Useability
 ArcGIS toolbar
 NEPAassist incorporation

Development
 New criteria; new data
 Refine/revise existing criteria



R6 Office of Planning & Coordination
Charge: Documentation

Demonstration of ArcGIS Toolbar



R6 Office of Planning & Coordination

GISST



Developers: Gerald Carney, Jeff Danielson,
Dominique Lueckenhoff, Sharon Osowski, David
Parrish, Joe Swick

Contributors: Mike Bechdol, Cathy Blus, Larry
Brnicky, Clay Chesney, Tim Dawson, Joel
Dougherty, Luis Fernandez, Bob Goodfellow,
Patrick Kelly, Paul Koska, Bill Klein, Angel
Kosfiszger, Eli Martinez, Tom Nelson, Dan
Parker, Hector Pena, Chris Ruhl, Mark Sather,
Abu Senkayi, Charles Spooner, Joyce
Stubblefield, Peggy Wade, Mort Wakeland, Mary
White

EPA Region 6 GIS Screening Tool for Environmental Assessment (GISST)



Sharon L. Osowski, Ph.D.
Ecologist
EPA Region 6



R6 Office of Planning & Coordination How did IH69 Streamlining Pilot start?

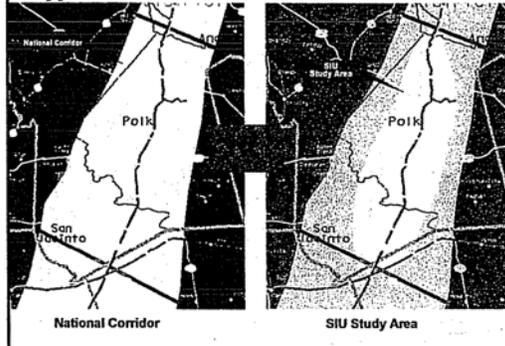
- IH69 Congressionally mandated corridor, but need to narrow to an appropriate size for more detailed field-level study
- Complex, large project w/ a lot of data and analysis needs
- FHWA: EO to streamline
 - coord w/ Fed, state, local agencies
 - Coord - 15 segment contractors & 1 project contractor



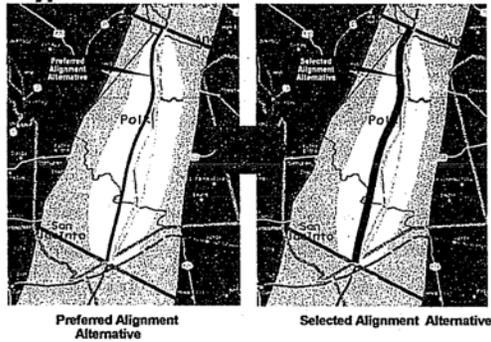
R6 Office of Planning & Coordination Case Study: GISST in Action--IH69



Hypothetical Schematic

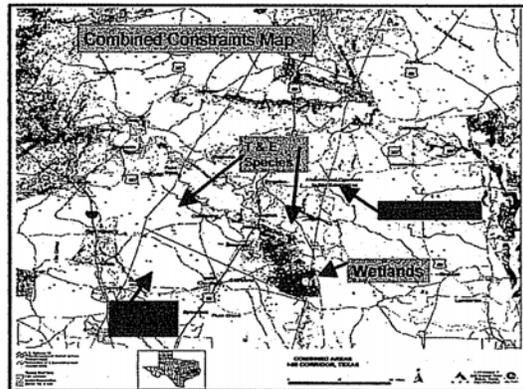
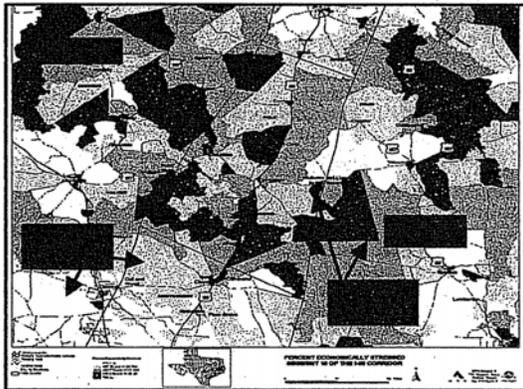
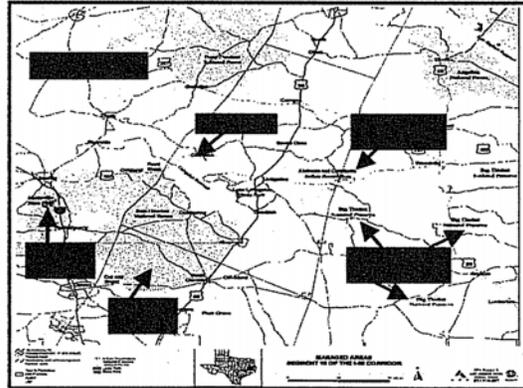
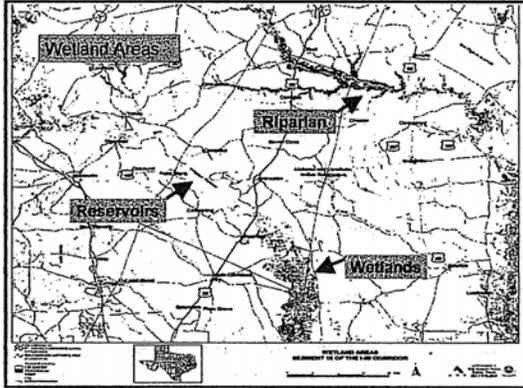


Hypothetical Schematic



R6 Office of Planning & Coordination Who developed GISST?

- Technical staff from each stakeholder agency agreed on the use of GIS, data sets, broad categories, and GISST
- EPA staff determined which categories (guidebook) could be captured as criteria, developed/modified criteria, and modified GISST formula



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How do "we" assess IH69?

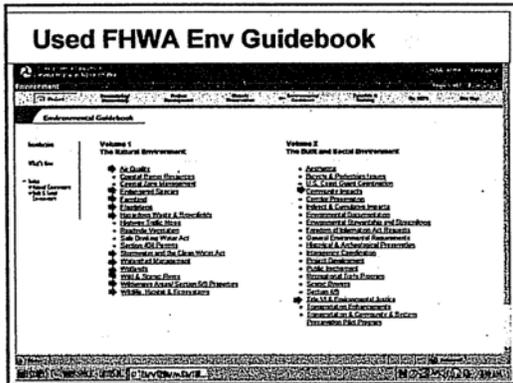
- **Identify:** purpose & need, stakeholders, regulatory requirements, data for study area
- **Data:** consistent across study area, regulators can agree on (Table 2)
- **Logistics:** avoid multiple contractor (15+) requests to each agency for same info
- **Process:** Outline ideas for assessment (e.g., use of GIS and other tools)

R6 Office of Planning & Coordination
GISST as an IH69 eval tool

- EPA Region 6 suggested GISST as a way to use electronic data and GIS to analyze potential impacts.

EPA staff had to decide

- What issues to analyze? & keep to a manageable number?
- Did data exist?
- Did EPA have an existing criterion or could one be developed?



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IH69 Criteria

New criteria had to be developed or modified for wetlands, floodplains, agriculture, managed lands, endangered species, ecologically significant streams

GISST "formula" had to be modified → one score per segment would not be a sufficient assessment

Grid method using 1 km² selected. Each criteria is applied to each cell. The summation of the scores for each criterion=cumulative score

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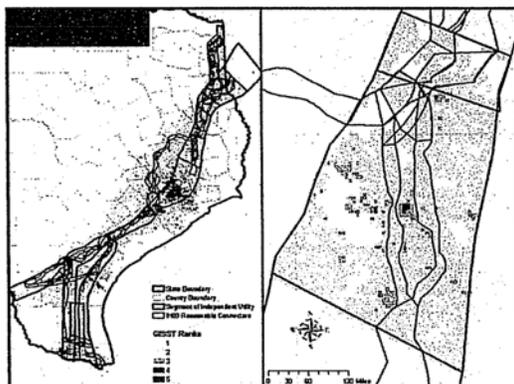
IH69 Example

How was it applied?

R6 Office of Planning & Coordination

IH69 Example

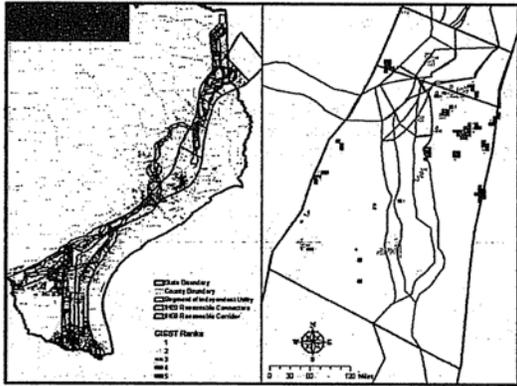
- EPA performed GISST and transferred the results to FHWA
- FHWA used GISST along with other information to narrow the Congressional study area to a "reasonable corridor"
- The reasonable corridor will form the basis for NEPA alternatives for a Tier I EIS (Corridor Preservation)
- EPA overlaid the GISST results with the "reasonable corridor" to determine how well the corridor avoided and minimized potential impacts



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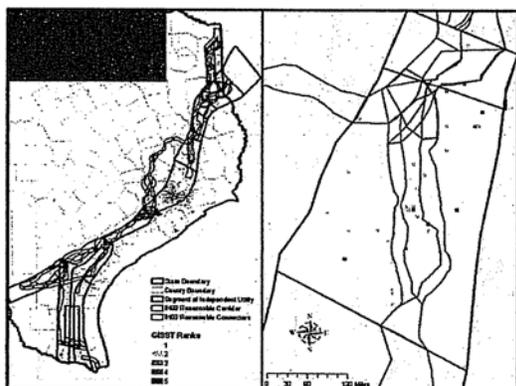
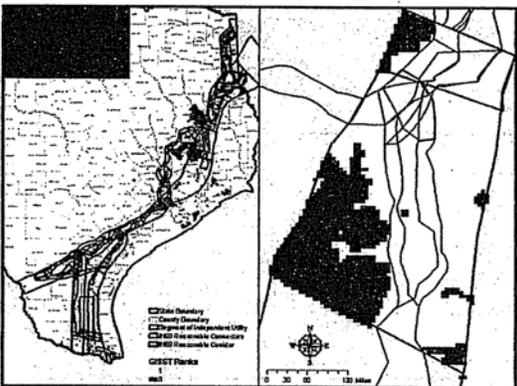
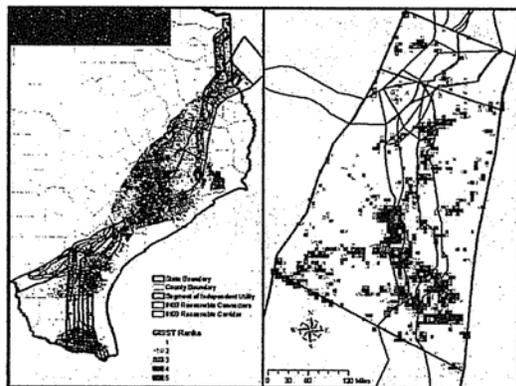
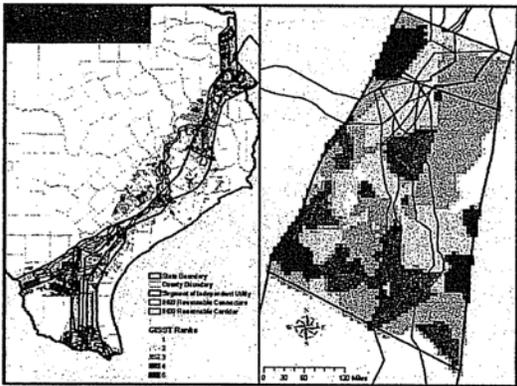
Minority

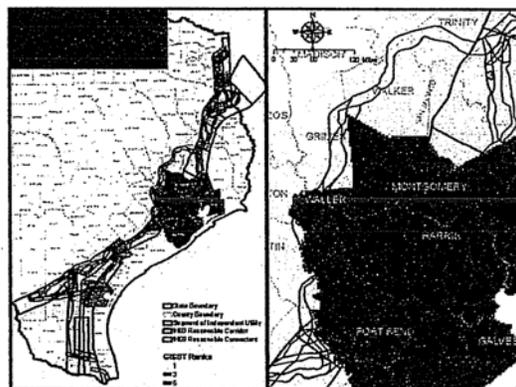
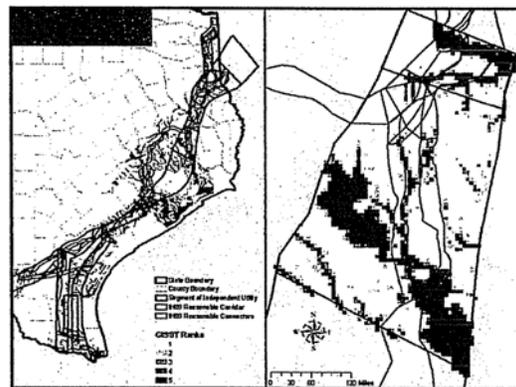
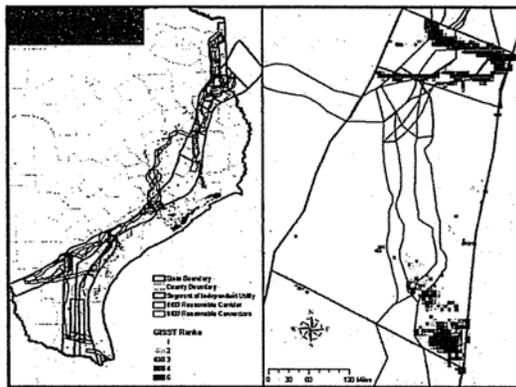
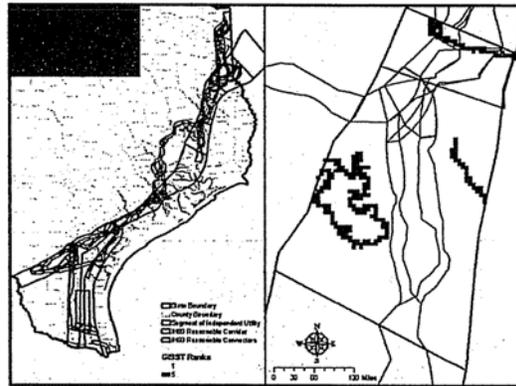
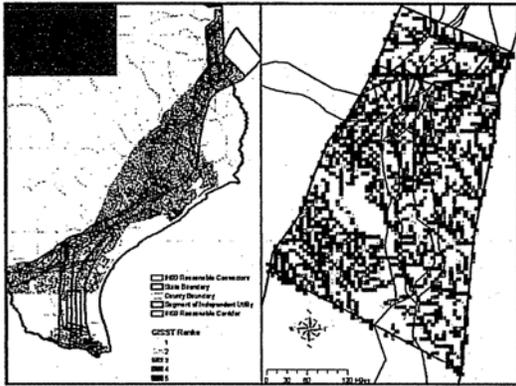
% Minority	Score
≤ 47.60%	1
47.61-63.31%	2
63.32-79.02%	3
79.03-95.20%	4
> 95.20%	5




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Economically-stressed

% economically stressed	Score
≤ 27.60%	1
27.61-36.71%	2
36.72-45.82%	3
45.83-55.20%	4
> 55.20%	5





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TEAP Diversity

% of cell (1km ²)	Score
Lowest 51-100%	1
26-50%	2
11-25%	3
2-10%	4
Top 1% most diverse cells	5

