

**Summary Minutes of the Science Advisory Board Regional Vulnerability  
Assessment Advisory Panel Public Teleconference  
April 14, 2005, 2:00 p.m. – 4:00 p.m. (Eastern Time)**

Panel Members: See Panel Roster – Appendix A

Date and Time: Thursday, April 14, 2005, 2:00 p.m – 4:00 p.m. Eastern Time

Purpose: The purpose of this teleconference meeting of the Science Advisory Board (SAB) Regional Vulnerability Assessment Advisory Panel was to discuss the draft advisory report of the Panel and identify any revisions needed in the final Panel report.

Attendees: Chair: Dr. Kenneth Cummins

Panel Members: Dr. Cynthia Gilmour  
Dr. Charles Hawkins  
Dr. Orie Loucks  
Dr. Michael Newman  
Dr. Ganapati Patil  
Dr. Charles Rabeni  
Dr. Mark Ridgley  
Dr. David Stoms  
Dr. Timothy Thompson

EPA SAB Staff: Dr. Thomas Armitage, Designated Federal Officer  
Dr. Anthony Maciorowski, Associate Director  
EPA Science Advisory Board Staff Office

Other EPA Staff: Ms. Jane Denne, EPA Office of Research and  
Development  
Dr. Bruce Jones, EPA Office of Research and  
Development  
Dr. Deborah Mangis, EPA Office of Research and  
Development  
Dr. Megan Megan Mahaffey, EPA Office of  
Research and Development  
Dr. Elizabeth Smith, EPA Office of Research and  
Development  
Dr. Paul Wagner, EPA Office of Research and  
Development

Others Participating: Dr. Robert O'Neill, TN and Associates

## Meeting Summary

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

### Convene Meeting, Call Attendance

Dr. Thomas Armitage, Designated Federal Officer (DFO) for the EPA Science Advisory Board ReVA Advisory Panel called attendance. He noted that the teleconference was being held as a public meeting under the requirements of the Federal Advisory Committee Act (FACA). The DFO is present at all such meetings to assure compliance with FACA requirements. Meeting minutes were taken by the DFO for the teleconference. Dr. Armitage noted that the minutes would be certified by the Panel Chair and made available on the SAB website.

### Purpose of the Call and Review of the Agenda

Dr. Kenneth Cummins, Chair of the Panel, thanked the members for participating on the call. Dr. Cummins noted that Panel members had been provided two drafts of the Regional Vulnerability Assessment Advisory Panel report. He stated that the Panel member comments on the first draft had been incorporated into the second draft that was provided to the Panel for discussion on the teleconference. Dr. Cummins stated that the purpose of the teleconference was to determine whether further revisions in the report were needed before it could be approved for transmittal to the Science Advisory Board. Dr. Cummins noted that he wanted to: 1) determine whether there were any inaccuracies in the report that should be corrected, and 2) make sure that references were provided to support statements in the report. Dr. Cummins noted that Dr. Elizabeth Smith of EPA's Office of Research and Development had submitted comments on the second draft of the report, and that her comments had been provided to the Panel.

Dr. Cummins indicated that he wanted to incorporate any necessary revisions into the third draft of the Panel's report and send it to members for final review and approval within two weeks after the teleconference. A Panel member stated that Dr. Smith had provided written comments to the Panel the day before the teleconference. He asked whether the Panel could have more time to review her comments. Dr. Cummins stated that following the teleconference, the Panel should review the EPA's written comments and send the DFO any revisions needed to correct inaccuracies in the report or provide additional information.

Panel members agreed that on the teleconference they would discuss any changes needed in the report and then further review EPA's comments to determine whether any additional changes were needed.

Dr. Cummins noted that some of the comments provided by EPA identified inaccuracies, while others highlighted differences of opinion with the Panel. He noted that it was important to separate differences of opinion from inaccuracies and to correct any

inaccuracies. Dr. Cummins then asked EPA to summarize their comments on the draft report.

### Summary of EPA Comments on the Draft Report

Staff from EPA summarized written comments (Appendix C) that had been provided to the Panel.

### Public Comments

Before beginning Panel discussion of the draft report Dr. Cummins asked if there were any public comments on the draft report. None were offered.

### Panel Discussion of Draft Report

Dr. Cummins asked Panel members to refer to the email sent to them on April 6, 2005 that listed issues identified by Panelists for discussion on the teleconference. The Panel then discussed a number of revisions needed in the report.

### Terminology

The Panel discussed terminology used in the draft report. Several panelists and EPA noted that the report should not indicate that ReVA provides a measure of “ecosystem health.” The Panel agreed that it would be more appropriate to use the term “ecological condition.” Panelists stated that the report should indicate that ecological condition is not well described in ReVA because temporal dynamics have not been captured. Panelists discussed revisions in the report language that could be incorporated in order to more clearly express this finding.

### Revision of the Transmittal Letter and Executive Summary of the Report

The Panel discussed the points raised in the draft transmittal letter and executive summary of the ReVA advisory report. Panelists noted that the transmittal letter should express strong support for continued development of ReVA and more explicitly acknowledge that the ReVA Program is not fully developed. Panelists also stated that the report should clearly state that the report provides recommendations to EPA for improvements in ReVA as the program is developed.

### Use of Spatial Data

The Panel discussed the statement in the report indicating that the use of solely spatial data in ReVA is a weakness. In this regard, panel members indicated that the report should recommend that data layers be tied to models that would enable consideration of temporal information. Panel members noted that the temporal perspective should be considered in ReVA. Panelists noted that predictive capability in ReVA needs to account

for spatial and ecological dynamics concerning transfer over time. Several report revisions needed to capture this concept were discussed and agreed upon.

#### Discussion of Recommendations Concerning Adjacency and Reachability Matrices

Panelists stated that the paragraph in the draft report concerning adjacency and reachability matrices required clarification. Dr. Patil offered to provide additional text containing an example and references that could be included in the report to clarify this recommendation. Dr. Ridgely also offered to provide additional text and references supporting the recommendation.

#### Discussion of the Recommendation Concerning use of Bayesian Techniques

Panel members noted that the recommendation in the report concerning the use of Bayesian techniques should be supported by an ecological example. Dr. Newman indicated that he would provide a reference to support this recommendation. Dr. Ridgely also offered to provide additional references on the use of Bayesian techniques.

#### Gradient and Surface of Vulnerability

Panelists noted that the report stated that a case had been made for vulnerability to have both a gradient and surface, and that a similar case should be made for ecological condition. Panelists noted that further explanation of this was needed in the report. Dr. Patil provided clarifying points and offered to write several sentences that could introduce the multidirectional gradient issue in the report.

#### Discussion of Report Text Concerning Spatially Constrained Clustering Tools

Panelists noted that additional examples of spatially constrained clustering tools should be provided in the report. Dr. Patil indicated that software is available to conduct this analysis. He stated that he had prepared a paragraph that could be inserted into the report, and that he could provide references pertinent to this topic. A panelist noted that it is not necessary to recommend one software package. It would be preferable to state that tools are available, provide references, and suggest that ReVA could take advantage of these tools. The Panel agreed to this approach and Dr. Patil offered to draft the revised text.

#### Discussion of Ambiguities Concerning the Analytic Hierarchy Process

Panelists stated that page 16 of the draft the report should more clearly identify what is meant by “ambiguities concerning the analytic hierarchy process”. Dr. Patil offered to draft several sentences clarifying this part of the report.

#### Summary and Next Steps

Dr. Cummins thanked the Panelists for their comments and stated that the revisions discussed on the teleconference would be incorporated into a third draft of the report that would be sent to the Panel for approval. He asked the Panel members to review comments provided by ORD and to send any required corrections or additional information that Panelists may wish to include in response to comments, as well as revisions discussed on the teleconference, to the DFO within two weeks for incorporation into the final draft. Dr. Cummins stated that the final draft would be then be sent to the Panel for approval to transmit it to the Science Advisory Board.

Dr. Elizabeth Smith of EPA's Office of Research and Development offered several additional comments for consideration by the panel as they complete final revisions of the report. Dr. Smith stressed that ReVA is currently under development. She recognized that additional documentation of ReVA is needed and noted that the program is making strides in this direction. Dr. Smith stated that ReVA is an applied research program and noted that it is unlikely that the program would be collecting new environmental information. She also mentioned a number of recent program accomplishments that address recommendations in the draft Panel report

Dr. Cummins thanked Dr. Smith for her comments and asked if there were any further public comments. Dr. O'Neill offered several comments. He noted that the Panel report is helpful but stressed that EPA is continuing to develop ReVA and that the SAB report should not be viewed as a review of a completed product. He referred the Panel to comments submitted by Dr. Smith.

Dr. Cummins again thanked the Panel and other teleconference participants for their comments. He asked the DFO to send an email to the panel identifying report revisions discussed and assigned to Panel members on the teleconference. He indicated that revisions should be provided to the DFO within two weeks so that a final draft could be prepared and sent to the Panel for approval in May.

Respectfully Submitted:

Certified as True:

**/Signed/**

**/Signed/**

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Thomas M. Armitage, Ph.D.  
Designated Federal Officer

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Kenneth Cummins, Ph.D.  
Panel Chair

## **Appendix A – Roster of the Regional Vulnerability Assessment Advisory Panel**

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### **U.S. Environmental Protection Agency Science Advisory Board Regional Vulnerability Assessment Advisory Panel**

#### **CHAIR**

**Dr. Kenneth Cummins**, Co-Director, Institute for River Ecosystems, Humboldt State University, Arcata, CA

#### **MEMBERS**

**Dr. Cynthia Gilmour**, Senior Scientist and Principal Investigator, Smithsonian Environmental Research Center, Edgewater, MD

**Dr. Charles Hawkins**, Professor, Department of Aquatic, watershed, and Earth Resources; Director, Western Center for Monitoring and Assessment of Freshwater Ecosystems, Utah State University, Logan, UT

**Dr. Orie Loucks**, President, ICValue, Inc., Oxford, OH

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

**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. Ganapati Patil**, Director, Center for Statistical Ecology and Environmental Statistics, The Pennsylvania State University, University Park, PA

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

**Dr. David Stoms**, Associate Research Scientist, 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

**SCIENCE ADVISORY BOARD STAFF**

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

## Appendix B – Teleconference Agenda

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**SCIENCE ADVISORY BOARD**  
**Regional Vulnerability Assessment Advisory Panel**  
**Public Teleconference**  
**April 14, 2005, 2:00 p.m. – 4:00 p.m. (Eastern Time)**

### Agenda

2:00 p.m.	Convene Meeting, Roll Call of Meeting Participants	Dr. Thomas Armitage Designated Federal Officer EPA SAB Staff Office
2:10 p.m.	Purpose of the Call and Review of Agenda	Dr. Kenneth Cummins, Chair
2:15 p.m.	EPA Comments	Dr. Elizabeth Smith, ReVA Director, EPA National Exposure Research Laboratory
2:25 p.m.	Public Comments	Dr. Thomas Armitage Designated Federal Officer
2:35 p.m.	Discussion of Draft ReVA Advisory Report	Dr. Kenneth Cummins and Panel
3:45 p.m.	Discussion of Next Steps, Process and Schedule for SAB Approval of the Report	Dr. Kenneth Cummins
4:00 p.m.	Adjourn	

## Appendix C – Comments Provided by EPA’s Office of Research and Development

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April 12, 2005

Thomas Armitage, Ph.D.  
Designated Federal Officer  
Ecological Processes and Effects Committee  
Science Advisory Board (1400F)  
U.S. Environmental Protection Agency  
1200 Pennsylvania Avenue, N.W.  
Washington, D.C.20460

Dear Dr. Armitage,

Thank you for the opportunity to review the draft “Advisory Report on EPA’s Regional Vulnerability Assessment (ReVA) Program”. We have reviewed the report and offer the attached responses to the questions posed by the SAB Committee:

1. Has the Committee adequately responded to the questions posed in the Charge?
2. Are any statements or responses made in the draft unclear?
3. Are there any technical errors?

Given that this was an advisory-level program assessment and is thus considered more of a mid-point check on our progress, research direction, and opportunities, we offer the following information as points of clarification:

- ReVA considers environmental vulnerability which may or may not include ecosystem health depending on available data and client needs.
- ReVA provides a flexible assessment framework for which the project needs and assessment questions are determined by the client and by the available data. These needs, assessment questions, and data are not static but will change with both region and with scale.
- ReVA advocates using a suite of methods and models to inform decisions rather than using one method to assess environmental condition or vulnerability (see p.54 in the methods report, first bullet).
- ReVA’s research deals with broad-scale geographic assessment ranging from multiple state regions to groups of counties or watersheds. It is unlikely that ReVA will ever work at the individual watershed-scale.
- ReVA’s web-based Environmental Decision Toolkit (EDT) is based on a statistical platform (S-Plus) to facilitate rapid reanalysis and display of data. It is not an ESRI product or extension.

We recognize the need for documentation throughout the program. As presented to the Committee in October, we have already begun this process via construction of an online tutorial for the webtool, a downloadable guideline for the approach followed by a book on the ReVA process, and documentation on all aspects of data ranging from collection and quality to when to use and minimum datasets.

We have also begun a number of analyses testing the sensitivity of our integration methods and have 3 manuscripts ready for submission. We are also including here the full list of publications related to ReVA over the years for the interest of the SAB Committee.

We are grateful for the support given by the SAB Committee and feel that the advice given here will strengthen the research that we undertake in the coming years.

Sincerely,

Elizabeth R. Smith, Ph. D.  
Director, ReVA Program

### **1. Has the Committee adequately responded to the questions posed in the Charge?**

For the most part, the responses adequately address the charges. However, there were some areas of uncertainty that we feel could use additional support if available. A number of these comments are interspersed throughout the report and are not clearly associated with a specific Charge question. We have tried to group comments that we feel we need additional information below:

#### **Related to Charge question 1, Strengths and limitations of the ReVA approach:**

(page 12) We would appreciate the panel providing more specific examples of how to go about field validating the integration methods. From our perspective, the concept of ecological condition is subjective and there can be many right answers or no right answer depending on how one defined condition and vulnerability. Validation suggests comparison to the truth or a right answer, which is not the purpose of our integration exercises.

(page 14) In order for us to address the issue of validation of statistical methods we need the committee to provide more specific examples related to multiple endpoint

ecological assessments. How do we determine which methods are “better”? (Note our criterion has been that if two methods give similar results, we advocate using the method that is computationally simpler, in order to make it more transparent to our clients as technology transfer is an important objective of our research).

**Related to Charge question 2, Effectiveness of the Web-based ReVA Environmental Decision Toolkit**

Our only concern here was the apparent perception that the EDT is a GIS-based tool, which it is not. Please see comments under errors.

**Related to Charge question 3, Usefulness of the ReVA approach to decision-makers**

There are a number of places in the SAB report that appear to us to be contradictory and we would like clarification.

The issue of integrated indicators or indices is raised a number of times. The report says that ReVA has a major strength in data integration but then casts doubt on the methods of integration we present. The report also recommends the use of the IBI (note we did try to model the IBI across the region but were unable to do, thus could not incorporate into the approaches used to date), and other indicators of ecological condition which do not have statistical underpinnings and are subject to the same criticisms that are made towards our work

(page 3 and page 4) strength of ReVA is data integration and conceptualization contradicted by later statement that we need to have more conceptual models and that we lack a framework.

(Page 11 strengths of EDT) ... *well-founded, scientifically defensible methods of extrapolation and interpretation of broader conditions* is contradicted by (Page 11 limitations) ... *The connections between the current data layers used to indicate vulnerability, and actual ecosystem health are tenuous, at best ...*

Throughout the report there are contradictions about ReVA’s suitability for priority-setting and for targeting of resources. (pg. 29, line 29-30. *ReVA is not well-suited for use as a priority-setting tool to target areas for more focused risk assessment –* and (pg 6, line 41-43) *Stressor/resource overlays are a powerful application of spatially explicit data and may be used as a priority setting tool to target areas for more focused risk assessments of specific problems.*)

**Related to Charge question 4, Issues associated with use of ReVA at multiple scales and future research priorities**

(pg. x, bullet 7) We have been unable to find, and ask the panel to provide us with, specific examples of dose/response models that incorporate a complex set of

endpoints, processes and relationships at a regional scale that might be used within ReVA. (Note: it is highly unlikely that ReVA will be applied at an individual watershed level as there are numerous other research projects already working at this scale, and within EPA, we do not have a client for this scale of research).

(pg. xi, bullet 11) We would benefit from the panel providing examples of other existing regional-scale data that might be used to improve or enhance the ecological conditions database (recall ReVA does not collect data so these data must be available from another source).

(page 7, first bullet) We are not familiar with any specific examples of where graph theory has been applied across a region for multiple endpoints and how it was validated. We ask that the panel provide such examples in order to help us in our future endeavors.

(page 8, and top of page 9) We ask the panel help us by providing justification for resource expenditures associated with evaluating a range of highly adverse changes that have a low probability of occurrence.

(page 14) We would like the panel to provide evidence and validation of neighborhood analysis as a preferred approach in order to justify its use. Against what other methods has neighborhood analysis been compared?

(page 15) As with neighborhood analysis, we ask that the panel please provide evidence that TOPSIS is better than other methods (e.g. AHP, ANP) in dealing with common data problems in ReVA, such as interdependency among criteria and data imbalance?

## **2. Are any statements or responses made in the draft unclear?**

We are unclear on the following statements and would like clarification.

(pg. 15, lines 18-20) *The discussion of Principle Component Analysis contains misunderstandings and inaccuracies concerning combining principal components and the roles of eigenvalues and eigenvectors.*

## **3. Are there any technical errors?**

We found the following errors:

(pg. x, line 36-37) All models developed by ReVA have been peer-reviewed and published.

(pg. 3, line 29) assessing *ecosystem health* is not our charge. Additionally, we know of no clear definition of ecosystem health that can be used as an assessment endpoint.

(pg. 4, line 15) *using solely spatial data to make predictions* is an incorrect statement. ReVA uses a combination of mechanistic and empirical models (based on our understanding of system processes) to predict current and future conditions across the region (see attached list of references from the public version of the EDT).

(pg 6, second paragraph) The SAB's definition of forecasting (consisting only of well-defined, calibrated, and validated mechanistic models) is inconsistent with that of the Millenium Assessment and of the International Working Group on Earth Observations (IWGEO).

(pg. 7, lines 21-22) *Measures of vulnerability in ReVA are dependent upon summing correlation coefficients.* The sum of correlation coefficients is never used as a measure of vulnerability - only to determine the most important stressors. The approach is backed by an extensive literature in ecotoxicology documented in the Methods report. Similar approaches have been used extensively in decision theory.

(pg. 12 and pg. 14) All integration methods developed by ReVA have been peer-reviewed and published.

(pg. 12) We did not include all data in our analyses - we removed variables that were highly correlated, reducing data set from 150 variables to 53.

(pg 13; pg. 17, lines 21-23) ReVA does not advocate using **one** integration method, model, or measure and would never claim to have the “**right**” one. We do suggest that a suite of both assessment questions and integration methods should be used to gain insights into conditions and vulnerabilities across a region – this is stated both in the methods report and on the EDT, and was included in presentations made to the panel.

(pg. 15, lines 6-7) *The discussion of the Simple Sum method contains inaccurate statements concerning skewness and its effects on values, averages, and variabilities.* The statement in the report is correct. The distribution in the report is the distribution across watersheds, not within a watershed; i.e., the sum of indicators within a watershed is not sensitive to the distribution of indicators across watersheds.

(pg. 16) Both the EDT and the Methods report list specific assessment questions that ReVA can address and which integration methods are best suited for those questions.

(pg. 17, beg w/ line 26) *ReVA definition of vulnerability does not include all essential aspects of Cairn's generally-accepted definition of ecosystem vulnerability...* ReVA is not charged with assessing ecosystem vulnerability, rather regional environmental vulnerability as defined by the client.

*An alternative and very useful application of ReVA would be to provide information that would enable the identification of geographic areas of the “highest value”. The ReVA approach as presented does allow this, however we are obviously constrained by available data that are consistent across the region, as well as how values are quantified.*

Based on the following quotes from the SAB report, it appears that the panel is under the erroneous impression that the EDT is a GIS (i.e. ESRI product) tool. The EDT is a statistical tool, developed using S-Plus (i.e. Insightful Corp. product ) software for web-based applications. The statistical application was chosen over a GIS application because of the speed of returning results when data are reanalyzed or recombined in alternative ways.

*The SAB finds that, while this is a laudable goal, the computing power needed to handle the data layers and process information is likely to be too great to practically allow such web-based applications in the near future. (page x, line 41)*

*Geographic information system technologies and quantitative integration and assessment methods are used in ReVA to derive future vulnerability estimates that include syntheses of modeled ecological drivers of change (i.e., estimated changes in pollution and pollutants, resource extraction, spread of non-indigenous species, land use change, and climate change) and resulting changes in stressor patterns. Integrative and visualization tools incorporated into ReVA can be used to illustrate the trade-offs associated with alternative environmental and economic policies in the context of dynamic stakeholder values. (page 1, line 30)*

*Within the ReVA layers, the impacts of individual stressors can be assessed and evaluated using GIS-analysis tools and presentations. The power of GIS is the overlays that can be generated and viewed for multiple stressors. (pg6, line 46)*

*Analysis of spatially explicit data using GIS and accompanying tools (e.g., Spatial Analyst), is a well-founded, scientifically defensible method for extrapolating and interpreting broader conditions from limited existing data. Representation of spatial data with GIS is a powerful tool for risk communication to users and the general public. (pg. 11, line 22)*

The appendix (pg 24-26) agrees with the methods report that the criticality is insensitive to fuzzy distribution. The appendix does it analytically, the report does it empirically because the report is addressed to a more general audience. The appendix implies that something is wrong because simply changing triangular to square distributions could not account for the results shown. But changing

distribution shape wasn't the only thing done in the report. We thus question the appropriateness of including the appendix as part of the SAB report.