February 10, 1995

EPA-SAB-EPEC-LTR-95-002

The Honorable Carol A. Browner
Administrator
US Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460

RE: SAB Review of the Environmental Monitoring and Assessment Program Landscape Component

Dear Ms. Browner

In its 1988 report Future Risk (SAB-EC-88-040) the Science Advisory Board recommended increased Agency attention to ecological matters, calling for a program to determine and analyze the status and trends of the nation's ecosystems. The Agency responded by initiating the Environmental Monitoring and Assessment Program (EMAP), which has grown to become the largest program currently conducted by EPA's Office of Research and Development (ORD).

The EMAP activity has undergone considerable peer involvement and peer review. Specifically, the EPEC has review numerous aspects of the program and issued three reports over the intervening years. In addition, the National Research Council has provided reviews of the program which criticize some of its on-going activities[1].

In 1993 the Agency asked the Ecological Processes and Effects Committee (EPEC) to review the EMAP-Landscapes (EMAP-L, which analyzes and interprets the landscapes) and EMAP-Landscapes Characterization (EMAP-LC, which generates information about land cover) programs. These programs are designed to incorporate the emerging field of

[1]There have been three NRC reports on EMAP: (1) A Review of EPA's EMAP, *An Interim Report,* 1992; (2) A Review of EPA's EMAP: *Forests and Estuaries*, 1994; and (3) Review of EPA's EMAP: *Surface Waters*, 1994.

landscape ecology into the fabric of the EMAP itself. Presentations were made by the key people on the interagency team that developed the landscape program research plan, Bob O'Neill of Oak Ridge national Laboratory, Kurt Riitter of the Tennessee Valley Authority, Jim Wickham of the Desert Research Institute, and Bruce Jones, EMSL-LV, EPA. The EMAP Subcommittee of EPEC reviewed the issue in a public meeting on July 19-20, 1994 at the Ramada Hotel Old Town in Alexandria, VA. This letter provides comments from the Subcommittee related to the questions in the charge (attached).

General Comments

EMAP-LC and EMAP-L programs have made timely and remarkable accomplishments in the last two years. Extremely noteworthy is the development of the Landsat Thematic Mapping (TM) data base for the entire country and the identification and evaluation of indicators of landscape conditions. It is evident that these accomplishments were due to the competency and dedication of the
members of the EMAP-LC and EMAP-L team and the leveraging of EMAP resources with other Federal Agencies.

The EMAP Subcommittee considers the Landscape components of EMAP to be critical to accomplishing EMAP goals and objectives. It is evident to the Subcommittee that this aspect of EMAP currently receives greater support and emphasis in EMAP than it received in the earlier years of EMAP. The Subcommittee encourages continued support for EMAP-landscape and EMAP-landscape characterization activities since they are essential to identify the extent and condition of ecological resources and can play a critical role in integrating across the landscape status and trends in the resources groups (e.g., surface water, forest, agroecosystems, estuaries, and arid lands.) Priorities should be established in the research plan for this integration.

There is confusion between the terms "EMAP-landscape characterization" and "EMAP-landscapes". EMAP-L is a component of EMAP that is developing new methodologies for analyzing landscape features through the advancement of landscape ecology and EMAP-LC is the component of EMAP that is facilitating acquisition of TM data to characterize the landscapes of the nation in concert with other federal agencies. To reduce confusion and to employ parallelism in terminology, we suggest "EMAP-landscapes" be replaced with either "EMAP-landscape analysis" or "EMAP-landscape interpretation".

EMAP management needs to recognize and support the important leadership role that EMAP-L and EMAP-LC have for all of EMAP. Even though the landscape work is only

about 8% of the full EMAP 1994 budget, the results from EMAP-L and LC and assessments are crucial to the success of EMAP; however, their linkage to the Resource Groups should be formalized. Therefore, it is essential to link the landscape research even more tightly and formally to address assessment questions. The EMAP-L/LC team and the Assesment Group should develop a clear explanation of the assessment approach to facilitate linkages for integration and assessment among the EMAP Resource Groups and other monitoring programs within the Agency (e.g., Near Coastal Resource Group and the National Estuary Program).

Responses to the Charge Questions

Charge Question 1: Has a sufficient case been made (by EMAP & EMAP-Landscapes) for the "need for landscape monitoring and assessment?

Yes. Landscape monitoring and assessment is a critically important component of EMAP. To be a success, EMAP must provide status and trend and resource stress information at the landscape scale.

Charge Question 2: Is the conceptual and theoretical foundation for EMAP-L sound?

Yes. The conceptual and theoretical foundation for EMAP-L is appropriately based on the science of landscape ecology. The constraint, however, is that the field landscape ecology is in an early stage of development. Indeed, the research and grant support provided by EMAP-L to the development of basic landscape ecology concepts and theory is a significant portion of all funding for this very important research area. It was noted that the potential exists in the scientific community to expand that level of effort many fold if additional resources were provided. The Subcommittee
believes this development of the conceptual underpinnings of landscape indicators, including what they mean ecologically across scales and societal boundaries, is so essential to the long-term success of landscape-level components of EMAP that significantly increased resources are necessary for this research.

Charge Question 3: Does the EMAP-L approach adequately address the EMAP objectives?

Yes. The objectives outlined in the Landscape Monitoring and Assessment Research Plan parallel the objectives of EMAP in terms of estimating status and trends in indicators of ecological condition. The EMAP-L component explicitly analyzes spatial configurational characteristics among ecological resources.

Charge Question 4: Is the proposed monitoring and assessment approach realistic?

The foundation of EMAP-L's approach to monitor status and trends in the condition of landscapes is remotely sensed TM data analyzed every 5 to 10 years. The Subcommittee feels that this approach to monitoring is realistic and scientifically sound and can be effectively implemented. Information presented to the Subcommittee on how the condition of landscapes will be evaluated (i.e., assessment) was in the preliminary stages of development. The approaches (i.e., indicators) being explored appeared to hold promise. However, a clear articulation of the EMAP-L's assessment approach needs to be developed before it can be evaluated for scientific validity or realism. The EMAP-L/LC team needs to develop a clear explanation of the emerging assessment approach. This will be of value not only to EMAP-L but to all aspects of EMAP since scientifically sound assessment approaches are critical to meeting EMAP goals.

Charge Question 5: Has EMAP-L involved basic science researchers in the conceptualization of its approaches?

Yes, within the constraints of its resources, EMAP-L has done an excellent job of involving basic science researchers in the conceptualization of its approaches. Bob O'Neill from Oak Ridge National Laboratory, a primary participant in EMAP-L, is one of the founders of modern landscape ecology. A number of other landscape ecologists have also been involved as primary participants and sources of technical input. Approximately 95% of the EMAP-L budget has gone to researchers outside of EPA, an impressive level of extramural involvement. EMAP-L has actively sought input from basic researchers on its approaches. For example, it was reported that ideas from surface water scientists expanded the thinking about landscape level indicators. Additional involvement with landscape-level researchers in other scientific disciplines, both within and outside of EPA, would be expected to provide comparable benefits.

Charge Question 6: Is the linkage between EMAP-Landscapes and EMAP-Landscape Characterization adequate to accomplish the goals of both programs?

The linkage between EMAP-L and EMAP-LC appears to be very well developed through the close cooperation of key personnel in each unit. However, there needs to be a formal linkage so that it is not just ad hoc or dependent on the specific individuals involved.

Charge Question 7: Does the EMAP-L approach provide a framework for integrating EMAP Resource Group data across scales? Will the approach enhance the ability of EMAP to do cross-ecological resource assessments?

The EMAP-L efforts hold tremendous promise for providing EPA with tools and a context for cross-ecological resource assessment. We anticipate that this landscape level information will allow the integration of resource group data in a way that supports assessment and decision-making at smaller scales by placing the Resource Group data in a broader environmental (ecological system) context. The scientific framework is rapidly developing in directions that will serve EPA needs. However, the organizational responsibilities and process for this integration within EMAP does not appear to be adequately developed. The Subcommittee is concerned that by default the EMAP-L and EMAP-LC components will become overly burdened by integration and assessment tasks when their primary emphasis should be on database development and the development and testing of landscape level methodologies for meeting EMAP's overall goals.

Efforts to date on integrating with Resource Groups (e.g., surface water, forests, and agro-ecosystems) have been fruitful, but have been conducted on an ad hoc basis. Formal efforts to link Resource Groups with the EMAP-L efforts must be undertaken. The EMAP Assessment group may be able to play a role as a facilitator of EMAP-L interaction with other Resource Groups in order to develop and implement tools that allow cross-ecological resource assessments. The Subcommittee recommends that the EMAP assessment group work closely with the EMAP-LC and EMAP-L groups to develop clearly defined goals and linkages between landscape level data and how it will be integrated with the data generated by the resource groups.

Charge Question 8: Does the EMAP-L approach increase the value of EMAP data in conducting ecological risk assessments?

The EMAP-L approach is consistent with the approach of the risk assessment framework yet the linkages have not been explicitly laid out. Now that the EMAP-L approach has been defined, it would be appropriate for the researchers to articulate the relation of the landscape approach to both the EMAP data from other resource groups and how all of this information relates to the ecorisk framework. The relationship between the EMAP-L approach and the Framework for Ecological Risk Assessment (EPA/630/R-92/001, 1992) is not explicitly made in the Landscape Monitoring and Assessment Research Plan (1994) nor in the presentations made to the Committee at the review.

Charge Question 9: Has EMAP-L worked to assure that results of efforts, to date, are reported to the landscape ecology community?

EMAP-L has reported research results via peer-reviewed publication in Landscape Ecology and other appropriate journals. Publication in peer-reviewed literature is critical to

the success of EMAP and is strongly encouraged. In addition, related publications should be serially numbered to facilitate reference and highlight the magnitude of the contributions of this program.

Charge Question 10: Has EMAP-L identified key technical issues that need resolution to implement the program?

EMAP-L has identified several key technical issues which must be resolved to implement the program. Five were enumerated in the presentation: (1) refinement of societal values/conceptual models, (2) landscape units and scales, (3) sampling designs, (4) landscape indicator development, and (5) synergism of different remote sensing data to evaluate landscape status and change. The Subcommittee concurs that these are the key technical issues.

Charge Question 11: Are the proposed research and development activities realistic and appropriate to resolve the major technical issues?

The proposed research and development activities to address the identified technical issues appear appropriate. However, there was no stated prioritization of those technical issues in the research plan, which was viewed by the committees as needed, given the limited available resources. The effort expended appeared to be greatest for technical issues 4 (Landscape indicator development) and issue 5 (synergism of remote sensing data) and substantial progress has been made. Work on issue 3, sampling design, should proceed concurrently with indicator development, since the two are interrelated. In particular, sample design issues related to integration/assessment with individual ecological resources (e.g. streams, forests, estuaries, agricultural lands) should be addressed early in the process, so that the landscape indicators chosen will be meaningful in terms of the ecological endpoints being measures by these resource groups.

Charge Question 12: Is the approach and organization of the MRLC [Multi-Resolution Landscape Characterization] a reasonable framework to meet our objectives?

The Subcommittee was impressed by EPA's leadership in coordinating the MRLC. It is cost-saving and time-saving and supportive of research to have a coordinated effort of data acquisition and processing. The MRLC approach and framework seem appropriate to meet the goal of providing a current baseline of global multi-scale environmental characteristics, and mechanisms for monitoring, targeting and assessing environmental changes. Denice Shaw is to be commended for her success in pulling the group together.

However, there are some issues that need to be dealt with in order to continue this successful record. EMAP needs to provide more personnel support to EMAP-LC so that ongoing activities can be fully supported while future activities are identified and developed. There are, at least, four ongoing activities that need some focused support:

(1) Quality assurance of the data - The EMAP-LC group recognizes the importance of well-documented, quality-assured data and has recommended steps to develop and implement information management efforts. Additional funds should be provided to develop and implement a quality control program, to develop data qualifiers related to precision, accuracy, and validation of land cover data.

(2) Validation - We encourage EMAP-LC to take a key role in this issue and to recognize the need for personnel with training in this area.

(3) Communication with the research community - although the researchers have done a good job of publishing the research results, we also encourage the dissemination of information about the availability of the MRLC data. This communication could be achieved by articles in the bulletins of scientific societies as well as posting on the INTERNET.

(4) Classification- We endorse the proposed interface with a committee of the Ecological Society of America to consider classification issues. However, EMAP-LC should recognize that significant time and effort may be required, so specific objectives should be developed to focus the discussions.

In summary, we were impressed by the amount of work accomplished, yet we are concerned that there are too few people for too many tasks. There is also a concern that EMAP-LC is susceptible to the loss of one key individual. We support efforts to formalize the work to date and recommend that ORD develop a strategic plan for the EMAP-Landscape Characterization program.

We have appreciated the opportunity to review this component of EMAP and we look forward to receiving a formal response to these comments. Further, we would like to know how the Agency will respond to recent comments on the EMAP resource groups from the NRC.

Sincerely,

Genevieve M. Matanoski

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Charge for the SAB Review of EMAP Landscapes

EMAP-Landscapes (EMAP-L) proposes to monitor and assess status and trends in landscape condition nationally using landscape indicators.

1. Has a sufficient case been made (by EMAP & EMAP-Landscapes) for the "need for landscape monitoring and assessment?
2. Is the conceptual and theoretical foundation for EMAP-L sound?
3. Does the EMAP-L approach adequately address the EMAP objectives?
4. Is the proposed monitoring and assessment approach realistic?
5. Has EMAP-L involved basic science researchers in the conceptualization of its approaches?
6. Is the linkage between EMAP-L and EMAP-Landscape Characterization adequate to accomplish the goals of both programs?

EMAP-Landscapes proposes that a national landscape monitoring and assessment program will bring several benefits to EMAP, as well as the environmental community in general.

7. Does the EMAP-L approach provide a framework for integrating EMAP Resource Group data across scales? Will the approach enhance the ability of EMAP to do cross-ecological resource assessments?
8. Does the EMAP-L approach increase the value of EMAP data in conducting ecological risk assessments?
9. Has EMAP-L worked to assure that results of efforts, to date, are reported to the landscape ecology community?

EMAP-Landscapes has proposed a series of research projects to resolve key technical issues that prevent implementation of the program.

10. Has EMAP-L identified key technical issues that need resolution to implement the program?
11. Are the proposed research and development activities realistic and appropriate to resolve the major technical issues?

The Multi-Resolution Landscape Characteristics Consortium (MRLC) is designed to meet the collective needs of the four national monitoring programs with regard to providing baseline land cover data.

12. Is the approach and organization of the MRLC a reasonable framework to meet our objectives?

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