

# **Recommendations for Improving the Quality of the User Experience in Digital Library for Earth System Education**



Submitted to the DLESE Steering Committee

by

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on behalf of the numerous community members who participated in the review  
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## **Recommendations to Enhance Quality in DLESE**

**Action Requested on All Policy Recommendations:** Review and approve (with any needed refinements) the proposed policy statements found herein to enable the Core Services to implement the Quality Plan.

**Response Desired on All Policy Recommendations:** During the January 18-19 Steering Committee Meeting

**Action Requested on All Procedural Recommendations:** None required by the Steering Committee

### **SECTION I. POLICY RECOMMENDATIONS ADDRESSING QUALITY OF RESOURCES AND COLLECTIONS DEVELOPMENT**

This sequence of policy recommendations presents a coherent approach to ensuring the high quality of library resources with Earth system science content or data that can be used for educational purposes (e.g. classroom resources, data sets, news, and pedagogical resources). In addition, these policy recommendations will result in new library infrastructure and programs that increase and broaden community participation and engagement in ways that fulfill the early vision of DLESE ... “as the intellectual commons for the global Earth system education community” (Manduca and Mogk, 2000). One of the cornerstones of this intellectual commons is to have resource creators and users exchange ideas on effective use and design of resources, providing constructive feedback to community members on their resources using formal and informal reviews, and giving peer recognition of excellence. Lessons learned in a decade or more of digital communication and community building show that DLESE must be proactive in building and maintaining its community. DLESE provides this stimulus by involving resource creators and collection builders in all areas of library collection building (creating resources, accessioning, formal and informal review processes, community comments). These are foundational elements for building a vibrant scientific and educational community. Through this set of policies, DLESE establishes a genuine, quantifiable relationship with every resource creator, collection builder, resource user, and resource reviewer, thereby further defining who we are as a community.

#### **I.A. Accessioning 3<sup>rd</sup> Party Resources and Collections**

Community representatives in the Resource Quality Working Group at the 2004 Quality Workshop recommend enhancing the eligibility requirements in the accessioning policy ([http://www.dlese.org/documents/policy/collections\\_accession.html](http://www.dlese.org/documents/policy/collections_accession.html)) to include an additional requirement that future accessioning of resources include information about the creator/author and that the creator/author be invited to participate in the accessioning and review process. See pages 3-4 in the Resource Quality Workshop Report.

### *Recommending Teams*

Resource Quality Working Group at the 2004 Quality Workshop

### *Proposed Policy Statement*

“DLESE will acknowledge the resource creator’s or collection builder’s contributions to the library and invite them to participate in the accessioning and review process.”

This proposed policy change affects the Accessioning and Deaccessioning Policy. The changes are reflected in red text on <http://www.dlese.org/Metadata/documents/katy/> - select the link to DLESE Accessioning and Deaccessioning Policy under the section Updated policies (changes highlighted in red). The specific new policy text reads –

Resource providers and DLESE work to together to:

- Acknowledge resource creators (if different than resource provider) and invite resource creators to participate in accessioning and review processes

### *Rationale*

Accessioning of 3rd party resources in the library is currently done without requiring the explicit approval or participation of the creator/owner. This can present a range of challenges including having a reliable contact point for maintaining resources in the library. The library as a whole is envisioned as a place of learning in which creators learn from the users of their resources and vice versa. Initiating contact with resource creators early on can help facilitate reciprocal relationships such as those described below.

“DLESE will serve as the intellectual commons for the global Earth system education community.” .... “The library can facilitate communication between new users and experienced users of library materials, between the creators and users of materials, and between learners, educators and scientists. Focus groups may emerge to explore a particular issue (related to science or education), and new collaborations may be formed, drawing on the strengths of workers in disparate fields.”

The Digital Library for Earth System Education: A Community Plan, p. 12  
Manduca and Mogk, 2000

This type of vibrant interaction can only occur when the creators/owners are aware their resource is in the library and voluntarily engage in community dialog and/or a review process, which provides feedback on the resources. With new review processes being implemented, resource creators/owners must buy-in to participation for them to be effective. Currently, we have no sense of whether a creator/owner is interested in participating in DLESE or shares DLESE’s goals.

DLESE has just completed development of a system for contacting all resource creators/owners when their resource is going to be accessioned. Identified as a way to recognize the resource creator/author and raise awareness of DLESE, this process of notification and inquiry into the creator’s/author’s willingness to have the resource reviewed is consistent with the original concept of DLESE. Collection builders will contact resource creators/owners when the collection builder identifies a resource desired for their particular collection. Creators/owners who indicate

they are not interested in the review process, and whose resources do not meet minimum standards, will not have their contributions accessioned in DLESE.

There was general agreement among the Quality Resources working group members that establishing relationships with resource creators who are aligned with DLESE's mission to maintain the highest quality resources is important, even if this practice limits library size. This position is supported by data from K-16 focus groups that quality is a high priority for K-16 educators (Sumner et al, 2000).

#### *Implied Changes to Work Plan*

The accessioning acknowledgment system will need adjustments to allow its use for this purpose. It is currently designed to run internally to the Technical Services with replies sent to the Technical Services staff. A mechanism for documenting the agreement by the resource creator/owner to allow cataloging and review of the resource must be developed. This might take the form of a metadata field.

#### **I.B. Instituting an Editor and Review Process**

Community representatives in Quality Working Group 2, as well as the Resource Quality Group and other participants at the 2004 Quality workshop, recommend implementation of a more formal internal resource review process in DLESE that is headed by a Managing Editor with the assistance of as many as a dozen Associate Editors (making up the Editorial Review Board) and many more ad hoc review teams or individual reviewers. See Working Group 2 report, discussion on the quality list serv and Recommendation 5 in the Resource Quality Group report for supporting documentation.

#### *Recommending Teams*

Working Group 2 and Resource Quality Group with broad input from the Quality Workshop participants.

#### *Proposed Policy Statement*

“All resources in DLESE will be reviewed for scientific content (accuracy and currency), pedagogy (if appropriate), and functionality. The metadata about all resources is also reviewed for quality.”

This proposed policy change affects the Accessioning and Deaccessioning Policy. The changes are reflected in red text on <http://www.dlese.org/Metadata/documents/katy/> - select the link to DLESE Accessioning and Deaccessioning Policy under the section Updated policies (changes highlighted in red). The specific new policy text reads –

Resource providers and DLESE work to together to:

- Perform a quality review in the areas of scientific content and accuracy, pedagogy (if appropriate) and metadata quality

#### *Rationale*

Support for peer-review of resources in DLESE has existed since its inception. The DLESE Community Plan (Manduca and Mogk, 2000) calls for the library to contain high quality resources and recommends peer review as a mechanism for ensuring creators of high quality

resources achieve academic recognition equivalent to a published paper for their efforts. This position was overwhelmingly supported by results of a survey on academic recognition in which almost 90% of the respondents endorsed peer-review as a mechanism for ensuring the reputation of DLESE as a quality library and the individual resources as worthy of academic recognition (Butler et al., 2000). These same respondents indicated that they would be willing to perform reviews. NSF (Colwell, 1999; Leinen, 2000) has maintained from the inception that peer-review is essential to ensure that the public and educators at all levels find high quality resources throughout the library.

"Any educator—indeed, any citizen—can enter the library, easily find what they need, and be assured that it has been reviewed."

Margaret Leinen, Associate Director NSF Geosciences, Spring 2000 AGU Meeting  
The Digital Library for Earth System Education: a National Science Foundation perspective

"Now being developed, the digital library will provide instructional materials, connect teachers with others who teach similar courses, and provide students with real-time data and information. The teaching resources will be peer-reviewed. We're excited that Earth science can offer some of the most dynamic, real-world, visual data at all levels of learning."

Rita Colwell, Director NSF, Fall 1999 AGU Meeting  
Complexity and Connectivity: A New Cartography for Science and Engineering Keynote Speech

While support for peer review has been strong since 2000, it has been difficult to implement because previous attempts relied almost exclusively on volunteer efforts. Review criteria and tools (e.g. the Community Review System) have been adopted and implemented for community review of educational resources in the library, but the volunteer effort has resulted in fewer than 10 completed reviews. Alternatively, the present multiple review pathways approach, which allows collection builders to handle review of their own collections, has not always met the criteria for independent peer review (e.g. some resource/collection reviews were done "in house") or consistently met the standards of the DLESE Reviewed Collection (e.g. with experience in collection building, quality of resources selected by paid catalogers improved). A more structured peer-review process internal to DLESE that allows the Managing Editor some flexibility in prioritization and process is desirable to achieve a greater number of high quality resources in the library and for the community to have confidence in the quality of those reviewed resources. The two community groups examining resource quality (Working Group 2 and the Resource Quality group) recommended that a single person be in charge and accountable to ensure that the peer review process was done well and consistently.

The Managing Editor will be selected by the Executive Director and Steering Committee and will report to the Executive Director. The paid Managing Editor would be responsible for oversight of the entire resource review process (Figure 1). Reviews will be conducted at the time of accessioning and when an existing resource is recommended for deaccessioning. Given the broad range of science, pedagogy, and user levels in the library, there will need to be discipline- or grade-level-specific Associate Editors to deal with content and pedagogical reviews (e.g., K-4, Middle School, High School/Intro Undergrad, Grad/Professional, and Data). These Associate Editors would be volunteers but will receive an honorarium and expenses paid to the DLESE Annual Meeting. These Associate Editors would comprise the Editorial Review Board, and

would assist in identifying and overseeing the work of ad hoc review teams and reviewers for thematic collections and individual resources. Due to their largely volunteer status, great effort would be made to ensure the Associate Editors and reviewers are only assigned a finite number of resources to review and that those resources are closely aligned with the individual's expertise. While a structured approach, this process would seek to entrain as many community members in the review process as possible to lighten the load on each individual and to embrace the broad expertise within our community.

Review of 9000 existing resources and as many as one hundred to several thousand new resources each year is a daunting process. Flexibility will be key if this review process is to be responsive and economical. The review load can be made manageable by prioritizing reviews based on importance of the collection, perceived quality, ability to potentially streamline the process due to previous reviews, and ability to assemble a specialized review board to conduct reviews of an entire collection. Review of the existing resources will be balanced against review of resources being accessioned in the library. The Managing Editor and Associate Editors would work to refine priorities based on information from the resource and collections contributors and Collections Committee. In addition, the Managing Editor and Associate Editors must have the authority to decide whether they can conduct a streamlined review on a resource or collection based on the strength of previous review work and whether a full DLESE review through an Associate Editor and review board is needed. An example case might be a collection of resources that have been thoroughly field-tested with appropriate educational audiences by the owner/creator or collection builder, but the scientific review process was not as rigorous. These resources could be accessioned after performing a scientific content review, while additional pedagogical review might be waived. The Managing Editor and relevant Associate Editor(s) would consider each case individually.

Judgment by the Managing Editor and Editorial Review Board will also have to be used when dealing with resources containing science content, but not directly intended for use in the classroom (e.g. science news items). These types of resources may only require content and metadata reviews, but no pedagogical review. (See more on review criteria in policy I.C). Additionally, a separate but complementary approach for review will be invoked when dealing with data sets.

Here we provide an example of how reviews might take place: an Associate Editor could assemble a team of seismologists, grade-level experts such as those involved in the US Educational Seismic Network, and pedagogical experts to review all the seismology related resources in the library. By reviewing them all in a focused effort the reviews become easier. In addition, the team would have a good understanding of what is in the library and what might be missing. This team would also be well positioned to recommend other high quality resources on this topic for cataloging.

Use of the DLESE Reviewed Collection criteria and the Community Review System tools in the review process will be encouraged. However, we anticipate that as more experience is gained in reviewing, the present review criteria may need some adjustments to ensure high quality, consistent reviews. In addition, the CRS tools will need adjustment to accommodate the proposed new model for reviewing collections in section I.C.



1) Notes: The number and specialization of members of the Review Board should be determined by review needs. Larger holdings like geology may need more AEs initially, while other topics may expand rapidly later and need multiple AEs.

2) Teams of reviewers will have expertise in content and pedagogy. Some teams will be organized to review a thematic collection. Others may be organized to review all resources in a content area.

The Collections Committee chair is proposing significant structural changes to the Collections Committee, which will wrap the work of the present Collections Accessioning Taskforce into the normal business of the Collections Committee. The recommendations seek a smaller committee with the Managing Editor as an ex officio member. Under this model, the Managing Editor will make recommendations about accessioning and deaccessioning of resources to the Collections Committee, which will make the final decision using all information available to them. There are concerns that this model will put undue burden on a volunteer committee and we expect to reevaluate this decision process at regular intervals. Additionally, the Managing Editor will bring policy level recommendations for changes to the review criteria to the Collections Committee, which will bring them to the Steering Committee after appropriate deliberation. If the changes are operational in nature, the Managing Editor will bring them to the Collections Committee and Executive Director for guidance.

### *Implied Changes in Work Plan*

A review tracking system will have to be acquired and implemented. A Managing Editor and part-time Administrative Assistant will have to be hired and Associate Editors recruited. Evaluation processes to determine the consistency and quality of reviews and the ease of use of the review tools and criteria will need to be implemented. The Managing Editor will be selected by the Executive Director and Steering Committee and will report to the Executive Director. The paid Managing Editor would be responsible for oversight of the entire review process for

resources. A small working group of representatives from other libraries and or traditional journals will be assembled to guide start up of this process.

The Managing Editor will make recommendations about accessioning and deaccessioning of resources to the Collections Committee, which will make the final decision using all information available to them. Additionally, the Managing Editor will bring policy level recommendations for changes to the review criteria to the Collections Committee, which will bring them to the Steering Committee after appropriate deliberation. If the changes are operational in nature, the Managing Editor will bring them to the Collections Committee and Executive Director for guidance.

### **I.C. Creating a Tiered DLESE Collection**

The Resource Quality Group with broad input from the Quality Workshop participants, Working Group 2, participants in the 1999 Portal to the Future workshop, and Strands 1, 2 and 3 at the 2004 Annual Meeting recommend the adoption of new minimum criteria for the DLESE collection of resources. Initially, the library will contain a three-tiered collection with each tier requiring increasing levels of review and documentation of quality. It will convert to a two-tiered model when all resources in the lowest tier have been reviewed. This model is based on community endorsement of a need to increase overall quality of library resources and a strong desire to clearly recognize those resources that have demonstrable educational impact.

#### *Recommending Teams*

Resource Quality Group with broad input from the Quality Workshop participants; also supported by the Working Group 2 and the DAWG white paper and the Community Plan, Strands 1, 2 and 3 at the 2004 Annual Meeting.

#### *Proposed Policy Statement*

“All resources accessioned into DLESE must meet the minimum criteria in the Accessioning and Deaccessioning Policy. Each resource in the library will be reviewed using these criteria.”

Notes: The DLESE Resource Quality Guidelines now incorporate the DLESE Reviewed Collection best practices adopted in April 2004. The above language for the policy reflects the actions needed internally to DLESE, i.e. actions performed by the Core Services. This proposed policy change affects the Accessioning and Deaccessioning Policy as well. The changes are reflected in red text on <http://www.dlese.org/Metadata/documents/katy/> - select the link to DLESE Accessioning and Deaccessioning Policy under the section Updated policies (changes highlighted in red). The specific new policy text reads –

These requirements apply to the contribution of groups of related items that are intended to be a distinct named collection. Collections have an organizing principle such as a theme, topic, audience, teaching strategy or some other criteria that can be clearly articulated. Items in the collection and the collection as a whole need to:

- Have each resource within the collection meet the eligibility for resources requirement above.

A second change under the Eligibility for premier resources section on the same page reads –

- Individual resources are eligible to become premier resources provided they have been

judged and documented to have demonstrable impact on geoscience learning. Please read the premier quality guidelines for information about how resources might meet this criteria.

### *Rationale*

Adoption of this policy will result in a higher standard of quality for all new resources to the library. Existing resources in the library (both the Broad and Reviewed Collections) will be reviewed against these criteria as well. Those that meet the minimum criteria will be placed in the new reviewed collection, called the DLESE Collection. Those that meet the minimum criteria and have evidence of demonstrable impact on student learning will be accessioned into the Premier collection. During a transition period while reviews of existing resources are ongoing, there will be a need for a third collection, the existing Broad Collection. It will be comprised of all Broad Collection resources and the existing resources in the DLESE Reviewed Collection that have not been reviewed through this new peer-review process. Resources will move from the Broad into the DLESE Collection after successful review, or will be deaccessioned if the owner/creator does not wish to bring them up to the appropriate standards. All new resources will enter the library into the DLESE Collection, so over time the Broad Collection will cease to exist, and we will return to a two-tiered collection. Resources accessioned into the Premier Collection will meet all the requirements of the DLESE Collection and must provide evidence of demonstrable impact on student learning. Documentation of successful field-testing for usability, pedagogical effectiveness and potential to inspire or motivate student learning is required as well. The Collections Committee will develop the criteria for acceptable evidence. One piece of evidence might include the volunteered reviews originating in the Community Review System.

The review process for entry into the new DLESE Collection will use a modified version of the Community Review system and will require a minimum of 3 reviews for each resource. Classroom and pedagogical experts using their expert knowledge and/or research on teaching and learning will evaluate resources for usability, pedagogical effectiveness, and potential to inspire/motivate students; field-testing by these reviewers would not be required. The review will couple science, pedagogy, functionality, and metadata issues in the assessment. Additional voluntary reviews by the community using the Community Review System will also be welcomed and used as appropriate in the review process (See policy I.E). Volunteered reviews through this system will be considered in the formal review process.

The original vision for the library was to have a high quality reviewed collection (DLESE Reviewed Collection) of resources and a second unreviewed collection (Broad Collection) that would serve as a test bed for materials under development (Manduca and Mogk, 2000, p. 9-10). A full range of formative assessment tools for improving materials were envisioned as well as peer commentary, testing and evaluation. In reality, the demands of building and testing the initial discovery and cataloging systems necessitated that many resources were cataloged into the library, specifically into the Broad collection, without regard for the original intent (Mogk, 2003 email communication to the Quality Workshop participants). Collection builders, resource creators, data tool providers and others continue to request a space within the library for the kind of interaction envisioned for the original Broad Collection, but this is not feasible in our current state. Further, the existence of the filtered, but unreviewed, Broad Collection is problematic for users who are unfamiliar with the different collections in DLESE. Many visitors to the library

assume all resources are reviewed and of high quality (pers. comm. S. Buhr, 2003 based on Evaluation Services data).

The new review process will address science content (accuracy and currency), pedagogical, and metadata quality criteria. However, reviews of resources must reflect the content of the resource, thus a resource containing only science content would not be reviewed for pedagogical effectiveness but could have annotations attached on how to use the resource most effectively. Currently all individual resources accessioned in the library have their metadata reviewed by Core Service staff. Collections metadata are reviewed with a sampling technique. In this new model, metadata for all resources would be examined. Criteria for reviews of data, images and models and other resources not wrapped in an instructional framework need to be developed and assessed using procedures described in the DAWG white paper. By necessity, the review process for resources in the library will develop and evolve over time as the community and editors gain experience. As policy changes are needed, the Collections Committee will bring recommendations to the Steering Committee.

The DLESE Collection will use the criteria for the DLESE Reviewed Collection and tools provided by the Community Review System (CRS). Some modifications of the CRS tool are needed, in particular, a change requiring a minimum of 3 reviews for a resource, and a change to evaluate pedagogical effectiveness using experts rather than field-testing. Pedagogical effectiveness, usability and potential to inspire or motivate students, which currently requires the reviewer to have used the resource, would be evaluated by experts capable of determining the potential for student learning based on what is known about effective instructional design and the ways people learn (Bransford et al., 2000). This reflects standards in other journal review systems that, for example, do not require reviewers to repeat an experiment or teach a lesson to validate its merit in review. Further, research shows that learning is contextual and that there is no way to guarantee that a given resource will be effective, motivational, or appropriate in a particular learning environment. This adjustment to the review process will remove one of the major barriers to completing resource reviews in the Community Review System. Further, it will significantly speed up the time and effort for resource review without compromising quality.

This tiered model of library development, combined with active review processes, will likely result in a small number of resources being deaccessioned, the quality of many other resources being improved, and will truly honor the community's commitment to enhancing the teaching and learning about Earth.

#### *Implied Changes in Work Plan*

Significant effort will be required by the Managing Editor to carry out these reviews. In addition, some modification or development of a parallel review system to the Community Review System will be needed. The proposed changes to the Collections Committee will eliminate the Collections Accessioning Task force but the full Collections Committee will take on their work. Tracking of documentation that a resource meets the requirements of the Premier Collection will require a new tool or service or an enhancement of existing tools. Creation of the DLESE Work Area within the library for sharing unreviewed developmental resources must be established. Greater effort by Technical Services staff will be required to verify all metadata.

#### **I.D. Post-Accessioning Use of the Community Review System and Annotation Systems**

The Community Review System and Resource Annotation System will operate in parallel with the Editorial Board process. The CRS specialist review function will be taken over by the Managing Editor and DLESE Editorial Review Board. See Working Group 2 report and Recommendation 5 in the Resource Quality Group report for supporting documentation.

##### *Recommending Teams*

2004 Quality Workshop Resource Quality Group and Working Group 2

##### *Proposed Policy Statement*

“Community volunteered reviews of DLESE resources are highly valued and encouraged for building and evaluating the library. Such reviews contribute to the quality of the library and provide additional information into and after formal reviews.”

Note: This proposed policy change affects the DLESE Collections Scope Policy. The changes are reflected in red text on <http://www.dlese.org/Metadata/documents/katy/scope.htm>. The specific new policy text reads –

Community volunteered reviews of DLESE resources are highly valued and encouraged in building and evaluating the library. Such reviews contribute to the quality of the library and provide additional information into and after formal reviews.

##### *Rationale*

The Community Review System and its associated annotation system are operational and seeing increasing usage. Community reviews through the Community Review and Annotation System can add value to the DLESE Collections and enhance the DLESE community in several ways:

- continually verify the quality of accessioned resources and ensure that a resource maintains its high quality,
- provide a source of methodical feedback from people who have used the resource for teaching and learning, to the resource creator for use in improving the resource,
- provide information for an instructor about how well a DLESE resource is working with his or her own students, in the form of a CRS Instructor’s Report,
- provide information for potential users of the resource about the strengths and weaknesses of the resource, as experienced by people who have used the resource for teaching and learning,
- provide tips and advice about how to use the resource effectively,
- provide empirical evidence about how effective the resource is with specific categories of learners, e.g. those with limited English or limited experience with technology,
- provide an additional source of information for use in assessing a resource’s suitability for the DLESE Collection,
- provide a source of field-based information about a resource’s pedagogical effectiveness, ease of use for learners and teachers, and ability to inspire or motivate students, when a resource is considered for the Premier Collection,
- enhance DLESE’s sense of community by establishing a “Virtual Share Fair” in which the experience and insights of teachers and learners are shared for mutual benefit

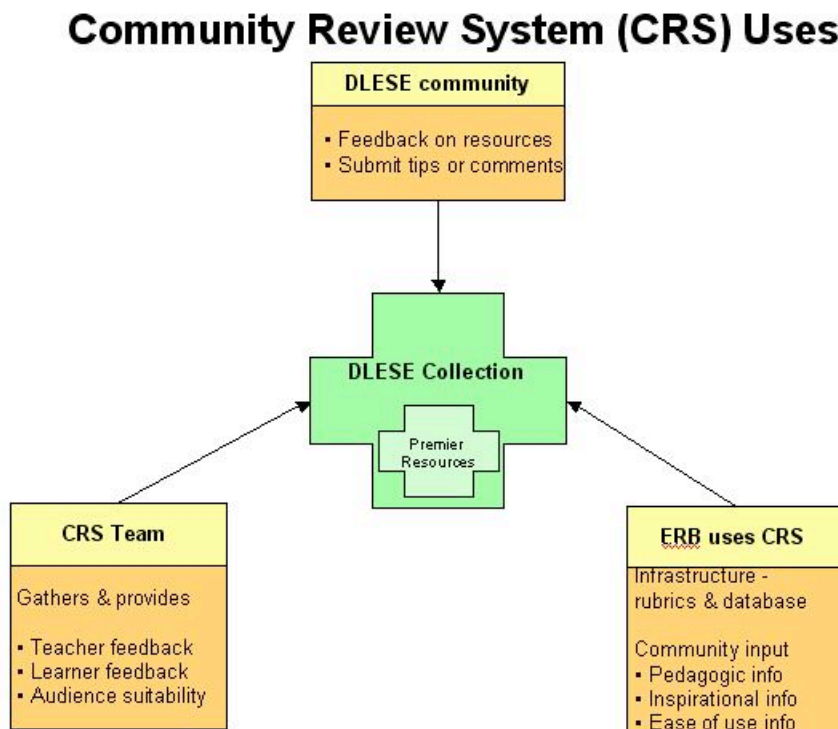
- reaffirm DLESE’s commitment to a library built by and for the community, and reaffirm our commitment in the wisdom of educational practitioners.

*Implied Changes in Work Plan*

The existing CRS Editorial Review Board function of supervising specialist reviews will be taken over by the new DLESE Editorial Review Board. Every effort should be made to capture and build on the insights and experience of the CRS ERB before it is disbanded. The two existing tracks of the CRS (“used for teaching” and “used for learning”) will continue as is. A third track will be developed for reviewers with relevant expertise evaluated the resource but did not watch or experience it being used for learning. The new track will have rubrics similar to the existing tracks, but will be worded in the hypothetical (“I think this resource would...”). The new track rubrics will be available for use by the reviewers recruited by the DLESE ERB, if so desired.

The CRS group will monitor community reviews of resources in all collections, and identify resources that have been well received by the community. When a resource is under consideration by the ERB, information from existing community reviews, including the text comments not publicly posted will be made available to the Managing Editor. An Editor’s Summary posted as an annotation will be written by the Managing Editor or supervising ERB member, for each resource upon its entrance to the DLESE Collection or Premier Collection. The other CRS annotations (Teaching Tips & Comments, Quantitative Indices, and Challenging Audiences) will continue as before. Figure 2 summarizes the envisioned role of the Community Review System.

Figure 2:



### **I.E. Assigning Publication Numbers to Resources in the Reviewed and Premier Collections**

DLESE can provide new levels of academic recognition to developers of resources by assigning publication numbers to all resources in the Reviewed and Premier collections. These publication numbers could be displayed by the developer on their website and be properly referenced in other documents.

#### *Recommending Teams*

Quality Workshop participants; also supported by the Academic Recognition Task Force, survey results and 2003 Annual meeting recommendations.

#### *Proposed Policy Statement*

“For recognition of their excellence, DLESE resources will be given the status of a formal publication.”

Notes: This proposed policy change affects the DLESE Collections Scope Policy. The changes are reflected in red text on <http://www.dlese.org/Metadata/documents/katy/scope.htm>.

The specific new policy text reads –

For recognition of their excellence, all accessioned resources are given the status of a formal publication.

#### *Rationale*

High standards of quality, creativity and effort deserve appropriate recognition. The DLESE community recognizes that the standards for entering the Reviewed and Premier collections go beyond the norm for resources generated by an instructor for their own use. The community wants to give appropriate recognition to those who make the effort. Assigning a reference number is one way to accomplish this. As with all peer-reviewed publications, there must be a way of referencing and verifying the quality. The DLESE reference number can provide this seal of authority. Verification that a resource has been reviewed and accepted by DLESE could be done by a quick search in DLESE on the resource reference number. Different reference numbers could be assigned to the Reviewed and Premier publications (using R### for Reviewed and P### for Premier) showing the status achieved in the library. Resource owners can be provided with a graphic identifying them as part of the DLESE Reviewed or Premier collection that includes their reference number. We will investigate conditions for issuing ISBN numbers or other formally recognized publication reference information as well.

#### *Implied Changes in Work Plan*

We will use the existing tuple metadata framework, which tracks name-value pairs to implement this feature. The Managing Editor will be responsible for assigning numbers once a resource is accessioned into DLESE.

### **PROCEDURAL RECOMMENDATIONS ON QUALITY OF RESOURCES**

The following procedural recommendations are provided to give the Steering Committee a fuller understanding of the changes implied by the Quality review and recommended policy changes.

*These procedures require no action by the Steering Committee.* The procedures below have been discussed by the Management Council and will be used as guides for future Core Service work. They may not be strictly followed as our understanding and experience in library development evolves.

### **I.F. Establishing a Work Area for Collaborative Development, Assessment and Testing of Resources**

The original vision for the library was to have an unreviewed collection that would serve as a test bed for materials under development (Manduca and Mogk, 2000, p. 9-10). A full range of formative assessment tools for improving materials were envisioned as well as peer commentary, testing, and evaluation. This area could be established with existing tools and services in the library and in doing so, catalyze individuals and groups to collaborate on resource development and teaching. The area would promote community driven collaborations in addition to those orchestrated by the Core Services or Steering Committee. This concept is consistent with establishing DLESE as the place to go for the highest quality resources and for a dynamic interactive community dedicated to enhancing the teaching and learning about the Earth.

Community groups, in particular the DAWG, have requested this functionality to facilitate DLESE as a place where participants with varying expertise can work together to create finished products that will ultimately become part of the collection. As a first level, they will design for their own needs but will do so with the broader community in mind. This work area will be a clearly identified repository for production materials – including data, metadata, draft educational modules as well as analysis and visualization tools that are under development. See the DAWG white paper.

In creating this area where developers can interact with the community, we can bring the true vision of the unreviewed collection into fruition and at the same time, ensure that users “can enter the library, easily find what they need, and be assured that it has been reviewed” (Leinen, 2000). The DLESE Work Area requires further discussion about the structure and services desired by the community. One point of agreement between workshop and working group participants is that the DLESE Work Area would have to be purposefully searched by a user rather than as a default in a normal search. This would prevent the casual user from falling into an area where the resources are potentially incomplete, not fully functional or scientifically accurate.

#### *Recommending Teams*

Resource Quality Group at the 2004 Quality Workshop, the DAWG and participants at the 1999 Portal to the Future workshop.

#### *Recommended Procedures*

DLESE will provide an area (DLESE Work Area) within the library for highly interactive, collaborative development, testing, and evaluation of resources to enable unreviewed resources under development to be shared and critiqued.

### *Implied Change in Work Plan*

An area in which developmental, unreviewed resources could be shared, tested and evaluated in a peer environment would have to be developed. Annotation and review services would need to be available to all cataloged resources in this area. The metadata identifying these resources as developmental would have to be created with the purpose of preventing these resources from being retrieved as part of a standard search. Instead, users would have to take deliberate action, e.g. specifically selecting the “developmental” collection, to retrieve these resources. A working group of resource creators/authors and educators should be assembled to further refine the structure of this developers area and the services needed.

### **I.G. Attributions for Resources**

Digital libraries face many issues with ensuring initial quality and maintaining future quality of the resources cataloged but not owned. A critical step in long-term quality assurance is engagement of the author/creator of a resource in the library and in our collective mission. While attribution information may go out of date, especially in the case of large agency websites, the attribution information provides a starting point when there is a need to contact a resource creator/author about issues of degradation of quality (e.g. loss of deeper links in a resource) during and after it is reviewed and accessioned in the library. Implementation of teaching tips and other forms of informal community review are greatly enhanced when the author can be kept aware of relevant community input. Thus, a corollary to the recommendation to contact resource developers when accessioning the resource in DLESE (Policy I.A) is the desire to provide library users and developers with information about resource creators with the resource or associated metadata. Attribution information on a website has long been recognized as one informal way of measuring quality among K-12 audiences. Credibility of the institution is often used to infer credibility of its resources and willingness to sign one’s work implies another level of credibility. The 2003 Quality Workshop participants recognized the value-added feature of including resources with attribution of the creator/author or the primary organization within the resource or its metadata. Recommendations from the 2003 Quality workshop resulted in a new Resource Quality Guideline for attribution (<http://www.dlese.org/Metadata/collections/resource-quality.htm>) that should be required of all future resources accessioned in the library.

### *Recommending Teams*

Resource Quality Working Group and 2003 Quality Workshop Report and participant comments

### *Recommended Procedures*

DLESE will accession only those resources for which the resource and/or its metadata have attribution information about the creator/author or the institution/agency (e.g. USGS) of the resource. This applies to all future resources accessioned in the library and creators/owners of resources already in the library will be encouraged to provide the information. To enact this procedure, the following statements must be added to the Metadata Quality Guidelines to accommodate the intent and goal of this policy recommendation and the policy change is no longer needed.

- Acronyms and abbreviations are spelled out, particularly in descriptions, titles and resource creator information.
- Resource creator information is sufficient in order to identify the origin of the materials.

### *Implied Changes to Work Plan*

No change required to the library services. The current ADN metadata framework already requires this information. The requirements were strengthened to accommodate the intent of the original policy. As reviews of existing resources proceeds, owners/creators will be contacted and asked to provide this information voluntarily.

### **I.H. Collection Review Simultaneous with Collection Development**

NSF is now directly supporting the efforts of thematic collection building by community members. This presents an opportunity to integrate resource review with collection development. Simultaneous development and review processes will be sought for all other new collections as appropriate. A tighter relationship between collection builders and DLESE is desirable to ensure DLESE receives the highest quality resources. DLESE oversight and guidance during collection building will help collection builders better understand and interpret the DLESE best practices and review criteria, prevent accessioning of sub-standard resources, and speed the overall review of a collection. To some degree this oversight is already occurring with technical staff and the Collections Accessioning Task Force as they help collection builders develop appropriate scope statements and selectively evaluate resources for their appropriateness in the library. See Working Group 2 report and Recommendation 5 in the Resource Quality Group report for supporting documentation.

### *Recommending Teams*

Working Group 2 and the Quality Workshop Resource Quality Group participants.

### *Recommended Procedures*

The DLESE Executive Director and Managing Editor will work with NSF, other funding agencies, and prospective collection builders to facilitate timely review of funded collections development projects.

### *Implied Changes in Work Plan*

The Executive Director and Managing Editor will work with NSF and other funding agencies as appropriate to institute a formal plan that integrates DLESE review processes in future proposals for DLESE collection building. Letters of collaboration between DLESE and prospective Principal Investigators will formally document how the process will be carried out and the costs involved. A process of standardizing letters of collaboration, and identifying free services and those done on a cost basis is ongoing within the Management Council, and will be completed in early 2005. All other work associated with this policy will fall under the normal workload of the Managing Editor to carry out reviews.

### **I.I. Developing Review Criteria for Data Resources**

DLESE can fill a distinctive niche in the geoscience community in providing a home for educational data sets, tools, and resources that utilize those datasets. The Data Access Working Group, Data Services, and Community Services have made much progress in demonstrating how teams of data providers, tool developers, curriculum developers and educators can develop integrated approaches to using data in the classroom. To move beyond the pilot phase, DLESE must have mechanisms for evaluating data sets and associated web sites for educational use.

A first step in this process is developing quality criteria for such resources. Participants in the 2004 Annual Meeting Strand 2 and the DAWG have developed a starting set of criteria. The second step is testing and evaluating these criteria before formalizing them and instituting a review process. Progress on defining quality criteria for data resources will proceed in parallel with proposed work on developing metadata frameworks for cataloging and retrieval. Metadata issues are being addressed in Metadata Procedural Recommendation II.A. (Providing Metadata for Data Sets).

#### *Recommending Teams*

Strand 2 from 2004 Annual Meeting and the Data Access Working Group. See 2004 Annual Meeting report and the Working Group 7 white paper.

#### *Recommended Procedures*

DLESE should develop, test and implement criteria and mechanisms for review of data resources with educational use.

#### *Implied Changes to Work Plan*

A pilot test and evaluation of proposed review criteria is needed and if successful, a formal review process must be developed.

## SECTION II. POLICY RECOMMENDATIONS ADDRESSING QUALITY OF METADATA

### **Overview**

“Metadata has at least five important purposes, each of which affects the quality of a library collection and user experience:

- to aid in decision making by a library user (e.g., whether to select a resource).
- to aid in decision making by library administrators (e.g., assessing breadth and depth of collections).
- to act as a foundation for other library services (e.g., providing teaching tips and other annotations).
- to provide the context for understanding a resource (e.g., the resource is an image/animation and the metadata description describes its meaning)
- to allow search over metadata and resource content for more precise search returns (see Deniman et al. 2003).

These identified purposes provide a framework for evaluating both the current educational metadata and any proposals for future additions of either metadata fields or controlled vocabularies.”

Working Group 5

The work of all groups examining metadata considered these varied uses and the impact they have on DLESE in particular. To this end, strong agreement was achieved among all working groups exploring mechanisms for improving the quality of DLESE metadata. In addition, the recommendations of the working groups and 2004 Quality workshop participants are consistent with the recommendations of the March 2004 Metadata workshop. The result of the quality review is an expansion of ideas for creating the required vocabularies and identification of a suite of research directions that will help inform future development and maintenance of metadata and vocabularies in the library. More detailed supporting information for the policy and procedural recommendations below are contained in the white papers from Working Groups 1, 3, 4, and 5 as well as break out group reports from the 2004 Quality Workshop. A metadata working group will be maintained to guide Core Service work on vocabulary development and to ensure the visual or structural framework proposed for explicating the library scope are consistent with the vocabulary.

### **II.A. Complexity of DLESE Vocabularies**

The community recommends that the complexity of DLESE vocabularies should be no greater than is required to meet end-user needs.

#### *Recommending Teams*

Working Groups 1, 3 and 4, and the Quality Workshop group on Metadata

#### *Proposed Policy Statement*

“DLESE vocabularies should be as simple as possible while meeting user needs, promoting naturalness of language and being informed by research on user behaviors and digital library development.”

NOTE: This updates the Vocabulary Management Process document at:  
<http://www.dlese.org/Metadata/vocabularies/vocab-mgmt-process.htm>

The specific text incorporated is –

The development of DLESE vocabularies should meet user needs, promote naturalness of language and be informed by research on user behaviors and utilized digital library developments and technologies.

#### *Rationale*

The current DLESE metadata frameworks use several controlled vocabularies. It is important to note that the library’s search capabilities are predominantly based on information retrieval techniques, consistent with current state-of-the-art search engine practices, that do not rely exclusively on controlled vocabularies. However, vocabularies underpin a variety of important library capabilities, including some aspects of search (e.g., searching by grade level), automatic construction of browsing features, filtering operations performed by web services, and collections assessment. Vocabularies also underpin important processes in review systems, such as automatically determining which set of review criteria should be applied to a particular resource (e.g., the criteria applied to ‘data-like’ resources are different from those applied to ‘instructional’ resources, or for matching reviewers and resources based on their specified preferences.

The participants of Metadata Workshop (March 2004) recommended expanding the current subject vocabulary to more adequately represent the breadth of the disciplines comprising Earth system science education. Additionally, working groups at the Quality Workshop recommended the development of an Earth system science (ESS) vocabulary using the discipline specific subject vocabulary as one facet of a multifaceted approach. The ESS vocabulary will enable DLESE to better support an Earth “systems” perspective across a broad spectrum of user services. The second highest priority was to explore a range of research questions identified by Working Group 5 concerning the needs and use of educational vocabularies.

While the exact computational representation of the Earth System vocabulary has yet to be determined, it is anticipated that this vocabulary will require a relatively complex form that emphasizes the relationships between terms; e.g., such as a thesaurus or ontological representation. This representation should specify a full range of concept relationships, allow or be capable of accepting user input of entry terms, and support programmatic manipulation and interoperability. Given the costs associated with vocabulary development, the Vocabulary Working Group in the Quality Workshop process also recommends that complex vocabularies should not be developed from scratch. Ideally, these types of controlled vocabularies should be co-opted/contracted for use from other existing and active projects/tools, yet be expandable by DLESE communities. In keeping with the existing DLESE emphasis on open standards and interoperability, implementation of the vocabulary should make use of recognized standards and languages as appropriate.

### *Implied Change to Work Plan*

Future changes in existing vocabularies will be vetted with a highly experienced working group in the area of vocabularies and metadata and, where appropriate, will be based upon pilot studies and/or existing research.

## **II.B. Linking Earth System Vocabulary with the Framework Explicating the Library Scope**

The community recommends linking development of the Earth system vocabulary and the proposed visual structures defining the library framework to increase efficiency of operations and consistency across the library. The Earth system framework and Earth system vocabulary will provide the foundation for additional services that teach users about Earth systems as they explore the resources in the library. See Working Group 1 and 3 reports and Metadata Group and User Experience Group report outs at Quality workshop.

### *Recommending Teams*

Working Groups 1, 3 and 4 and Workshop Groups on Metadata and User Experience

### *Proposed Policy Statement*

“The library will include an Earth system vocabulary and the operational framework that explicates the library scope and balance of content. These library capabilities should ensure high quality and consistency in accessioning, cataloging, metadata, interoperability, and the user experience.”

NOTE: This policy change updates the vocabulary management process document and strengthens the metadata quality guidelines at:

<http://www.dlese.org/Metadata/collections/metadata-quality-guidelines.htm>

The specific text is –

For those resources describing and emphasizing Earth systems information, processes, and concepts, metadata descriptions include appropriate classification within the Earth system framework.

### *Rationale*

Development of an Earth system vocabulary depends on the same understanding of concepts and the linkages among them as does the proposed development of an Earth system framework to explicate the scope of the library. Both the vocabulary and Earth system operational framework must accommodate differences in vocabulary use by the varied library audiences and provide opportunities to move from broad overarching concepts to more detailed concepts. A final requirement for development of both frameworks is that they are easily scalable and that a plan for growth over time is in place before development is completed.

As an example of how to align the Earth system vocabulary and framework, the vocabulary words in the metadata can be used as nodes in the concept maps. As the vocabulary and the framework become more refined these two components of the library would stay linked and coherent, as is reasonable to meet user needs. Both should begin with analysis of prior and

current working models. Specialist teams with expertise in vocabulary development, visualizations, and earth system content can develop components of the framework and vocabulary. One or more working groups with this specialized expertise should work toward the following: a grade-level appropriate underlying concept framework, a technical strategy to support multiple views, and an agreement on facets to support the concept framework.

#### *Implied Change to Work Plan*

Earth system and education vocabularies will be developed in concert with efforts to define the Earth system framework for DLESE. An expert working group that assists the Core Services in development and coordination of both will be needed as will mechanisms for supporting their communication and work.

### **II.C. Metadata Creation**

The community recommends that DLESE push toward greater use of automated classification and metadata creation to better manage creation of metadata for new resources and reassignment of metadata as vocabularies change.

#### *Recommending Teams*

Working Groups 3, 4 and 5 and Quality Workshop Metadata group

#### *Proposed Policy Statement*

DLESE will have consistent, high-quality metadata produced in a time-efficient manner and by cost-effective methods.

NOTE: This policy change updates the guidelines for metadata quality at:  
<http://www.dlese.org/Metadata/collections/metadata-quality-guidelines.htm>

The specific text is –

It is very important that DLESE have consistent, high-quality metadata produced in a time-efficient manner and by cost-effective methods. This is a requirement and ensures records that are effective and efficient to support library services.

#### *Rationale*

A number of funded efforts provide opportunities for DLESE to explore new mechanisms for automated classification including work being done on educational standards (E. Liddy at Syracuse), grade-range classifications, and geospatial-coverage estimation (building on Alexandria Digital Library tool), to name a few. In addition, exploiting the power of an ontology can strengthen these efforts. The community recommended in their white papers a number of research directions that might be explored to further this effort.

#### *Implied Change to Work Plan*

A greater priority will be placed on identifying existing or developing new mechanisms to automate metadata generation. DLESE will pursue vigorously use of automated and hybrid approaches to classification and metadata creation for new resources and reassignments of metadata as vocabularies change.

## PROCEDURAL RECOMMENDATIONS ADDRESSING QUALITY OF METADATA

The procedural approaches described below are currently being considered by the Core Services to assure the quality of metadata across DLESE. *No action is required by the Steering Committee.* This information is provided to give you a more complete view of the scope of quality enhancements proposed for the library. These recommendations will be used to guide vocabulary development, but may not be strictly followed depending on how other parts of the library evolve and our knowledge and experience in vocabulary development expand.

### **II.D. Implementing an Earth System Vocabulary**

The Strategic Plan and Integrated Work Plan call for implementing an Earth system vocabulary by version 3.0 of the library. A 300-word vocabulary was prototyped in 2004, but is not operational. It and a number of other vocabularies developed in support of thematic collections will be explored in the next phase of vocabulary development and implementation.

#### *Recommending Teams*

Working Groups 3 and 4 and the Quality Workshop Metadata group. See Quality Workshop Metadata group recommendations and Working Group's 3 and 4 white papers.

#### *Procedural Recommendations for Developing the Earth System Subject Vocabulary*

- An Earth system vocabulary working group should be formed to immediately revise and expand the current 30 word subject vocabulary to as much as 40 words and balance the terms to provide coverage of the Earth science disciplines.
- Work to develop a fully faceted vocabulary that is more Earth system oriented and intended to evolve should begin immediately after expanding and revising the existing subject vocabulary. This vocabulary should: start small to ensure a very short development time; be designed for growth, drill-down, and managed change; link to one or more high-levels in the Earth system framework; use a multi-facet approach; be designed for scalability; and embrace the interim 30-40 word vocabulary as a discipline-oriented facet.
- The process to create a fully faceted Earth system science vocabulary should be linked to creation of the Earth system framework explicating the scope of the library (See policy II.B above).
- The scenario for growing the Earth system subject vocabulary centers on pilot studies and collaborations with thematic collection builders who have created subject vocabularies to accompany their collection. Different facets of the vocabulary could be populated with vocabularies from existing collections and testing could be done with the metadata from that collection. This process would establish a social pattern for development that can be iterated upon in different subject areas.
- As a pilot project, the community recommends determining the technical issues and processes for incorporating thesauri or ontologies. This might be done by taking the current subject list and putting it into a thesaurus or ontology structure and discovering what issues emerge. A second part of the pilot would be to add terms and create relationships within the thesaurus or ontology. Adding related terms to the subject list or creating relationships with words in other ontologies could do this, and would help determine scalability of the

vocabulary over time. This approach also provides flexibility as the framework explicating the library scope is developed.

- Incorporating mechanisms to allow searching of individual collections (e.g. using the collection-specific, locally developed, controlled vocabularies) through DLESE represents a critical element of the technical framework design and, when appropriately addressed, will provide the recognition and high level of services desired for collection builders. Currently, collection builders can input local vocabularies in the keywords element, which can improve retrieval of resources from these collections, but this is not sufficient.
- The keyword element process and method of integration of locally developed vocabularies should be made more transparent (through documentation and/or a demonstration of a separate proof-of concept) to both collection builders and end users. This process is facilitated through the use of the previously described standards for ontology or other controlled vocabularies.

#### *Procedural Recommendations for Maintaining a High Quality Earth System Vocabulary*

- Language growth and change is a crucial quality issue in maintaining vocabularies that was not fully resolved by any of the community groups, although several approaches were identified. Maintenance issues of the vocabulary must be resolved early in the development process, but the main focus in the short term (1 year) is examining the vocabulary and prototyping the technical framework.
- Long-term quality of metadata and vocabularies depends upon a strong research base. DLESE should encourage and support investigations that build towards a cumulative research framework for understanding users information behaviors in educational digital libraries. Potential areas for further research and understanding include the quality of metadata created with differing levels of training and support; challenges of integrating the metadata of heterogeneous information resources, impact of variable metadata on retrieval and use, impact and use of vocabularies in teaching and learning tasks; use of vocabularies in other tasks: information retrieval, class preparation; and the use of browse structures versus search in different educational contexts (For example, when do educational users browse and when do they search? At what point of granularity and hierarchical structuring does the controlled vocabulary fail as a browse structure?).

#### *Implied Change in Work Plans*

Expertise in vocabulary development will be sought from outside the Core Services to complete the work. Additional funding will be required to complete this work. However, oversight of this work could be done within the Core Services with additional input from a community working group of vocabulary and content experts. A new effort will be required to evaluate and update existing metadata to reflect the new vocabulary. Opportunities for community contributions to research on metadata and vocabularies will be encouraged. New tools and services to support conversion / updating of metadata will be needed. Developing a long-term strategy for vocabulary evolution maintenance is also a new effort. While much of this work is not presently in the immediate work plans of the Core Services, it is work that should be considered routine in the development and evolution of a digital library. Thus, over the long term we can expect continued effort and expense dedicated to vocabulary and metadata change and maintenance. This was one of the highest priorities of all community groups, from strand participants in annual

meetings to the participants in the quality review. Thus, redirecting funding and effort to complete the vocabulary is merited.

### **II.E. Enhancing the Education Vocabulary**

Use of education metadata and associated information by educators, library developers, and catalogers is poorly understood. There is need for small research studies to inform more comprehensive approaches to developing these metadata before any changes in policy or vocabularies are recommended. DLESE can inform the broad digital library community about the needed research and build partnerships to engage experts in this work.

#### *Recommending Teams*

Working Groups 3 and 5, and the 2004 Metadata Workshop participants

#### *Procedural Recommendations for Enhancing the Education Vocabulary*

- The primary recommendation regarding education vocabulary development or refinement is to study what is useful to the user (educator, librarian, collection builder) before embarking on any extensive prototyping or changes to these fields. Additional research focusing specifically on the use of teaching method, instructional goals, and resource type is needed. This research should build on that being done by GEM, SERC, and other digital library projects as well as the earlier DLESE studies. Research studies into the value of theory-based resource characterizations are also of value to DLESE. These will probably entail development of a special vocabulary for education theory and design.
- The second priority for improving the education vocabulary is to test existing vocabularies and any proposed new vocabularies in small prototype projects for their usefulness in achieving DLESE's goals, minimizing the cost and time burden on collection and library builders, and meeting the needs of library users, before applying them to all DLESE collections or retrofitting existing metadata. Further, weighing the value of adding one vocabulary against the value of others in terms of cost and benefit to the broad community should be continued.
- While DLESE has unique vocabulary needs it is important that NSDL and other digital libraries serving science education inform DLESE education vocabulary development.
- DLESE should consider multiple options for creating and linking pedagogical information with educational resources including metadata elements (e.g., relation), controlled vocabularies, and annotations based on research into user needs and behaviors.
- Collection builders can continue to use all educational fields in the ADN metadata framework while cataloging best practices are still under development.

#### *Implied Change in Work Plans*

These recommendations will require a number of focused evaluation, research and/or pilot studies that bring experts from the community together with Core Service staff to explore the issues raised. As we develop greater understanding of what is needed and how to implement changes, new efforts by the Core Services will be needed.

### **II.F. Assuring the Quality of Assigning Metadata**

Consistent assignment of metadata by experts and novices is a challenge faced by all digital libraries and related efforts. Experts gain experience and become more proficient, however

experience shows that experts are prone to “definition drift”, i.e. the definition of a term in the expert’s mind evolves over time (personal comm., S. Tahirkheli, 2004). Novices have less familiarity with the definitions of classification terms and as a result may have greater variability in assigning resources to the same classification term. In addition, the time required for a novice to become proficient is significant. To date, human expert intervention in this process generally results in higher quality assignments, but the time and energy involved is large. Hybrid approaches employing human monitoring of computer-generated classifications should be pursued as a viable option. Specific recommendations to enhance the quality of current metadata:

- Rigorous metadata creation may appear to be too time-consuming and costly but with training and mediation by different parties metadata quality can be improved. By mediation we mean that metadata, for a single resource, may be created by several parties: the author for elements such as title, a subject specialist for subject, an intermediary knowledgeable in library data management as well as education for metadata useful in various educational information and instructional use/user contexts. The accessioning process for collections provides some quality control on resource metadata, and validation processes in the resource review can enhance this. For example, subject and pedagogical experts could validate relevant components of the metadata associated with a resource.
- Extend the National Science Education Standards to the fourth level to provide greater granularity and to align with state standards efforts.
- The National Science Education Standards (NSES) contain grade range information. For those resources that are associated with NSES, consider using the NSES grade range information to complete other grade range metadata fields.
- Extend geospatial cataloging where gaps are present.
- Assigning grade level to resources in K-5 has been shown to be more difficult and problematic than for other grades. The community recommends reviewing the 1700 resources assigned to the K-5 grade level using an experienced educator with direct classroom experience at these grade levels. NSES content standards metadata could be verified at the same time.
- DLESE knows a great deal about the process of accessioning collection metadata, but very little about the perspective of the collection builder in creating that metadata. Evaluation Services could explore the needs and issues of collection builder concerning metadata development. A small working group is being formed to inform changes to the [dlese.org](http://dlese.org) interface to collections. This working group could serve as a focus group on metadata issues as well.

### *Implied Change in Work Plans*

Each of these recommendations needs to be completed in a manner that reflects overall priorities in the library and takes advantage of synergistic activities. They all represent standard work for the Core Services and require no new expertise. Review of some metadata can occur in conjunction with review of resources. Partnerships with other digital library projects will be pursued to manage the workload, as well.

## PROCEDURAL RECOMMENDATIONS ADDRESSING QUALITY OF METADATA FOR DATA SETS

The procedural approaches described below are designed to assure the quality of metadata for data sets in DLESE. *No action is required by the Steering Committee.* These recommendations will be used to guide vocabulary development, but may not be strictly followed depending on how other parts of the library evolve and our knowledge and experience in vocabulary development expand.

### **II.G. Providing Metadata for Data Sets**

Improving the accessibility and use of data resources in support of Earth science education is a core goal of DLESE. Currently, data resources can only be retrieved when wrapped within an educational resource. Ideally, all data will be tightly linked to instructional resources and the tools needed to access and use the data, but achieving this goal also requires direct access to small, educationally oriented datasets. The Data Access Working Group (DAWG) is collaborating with the Data Services and Community Services groups to explore ways of integrating data into DLESE in forms that are accessible to curriculum developers and appropriate for use by all types of library audiences. Enabling the creation of educationally useful resources using currently inaccessible scientific datasets is a potentially distinctive and useful niche for DLESE.

The community recognizes that there are a number of the special concerns for including data resources and collections in the library, the first of these is developing metadata for discovery of datasets. Others include the need for tools to make the data available; the variable nature of the data and the need for some datasets to be regularly updated, the relative size of data collections, the need for an understanding of how to integrate data into DLESE, the need for better knowledge of the user base. The recommendation for establishing an unreviewed developers collection (Policy I.G in Resource Quality Recommendations) also supports this effort to explore how best to incorporate data in DLESE and in Earth system education.

The white paper from the DAWG is comprehensive in laying out the challenges and makes a number of recommendations on how to move forward on developing partnerships with and among data providers, tool developers, curriculum developers and educators. At this stage, pilot studies are needed to further demonstrate how data can be provided in educationally useful ways and needed tools and curriculum can be collaboratively developed on a larger scale.

#### *Recommending Teams*

Working Group 7 (Data Access Working Group), the 2004 Metadata Workshop participants, and the Quality Workshop Metadata group. See page 10 of the Metadata Workshop recommendations, Quality Workshop Metadata group recommendations from day 2, and Working Group 7 white paper recommendations.

#### *Procedural Recommendations for Developing Metadata for Data Sets*

- Community Services has funding to test and develop metadata frameworks for cataloging and discovery of data-rich resources using SERC's NSDL "Using Data in the Classroom" portal as a prototype. The testing will refine our understanding of the metadata needed for

discovery of data, tools, and activities. It will also identify ways to convey the match between the sites and tools and the criteria for supporting effective educational use. The metadata framework must work for DLESE library users as well as the many data providers, tool developers and curriculum developers who may provide resources or services to DLESE. For example, Data Services is working to identify ways for combining DLESE and THREDDS style metadata to better integrate data and educational resources.

#### *Implied Changes to Work Plan*

This effort is part of the funding and current work plan for Data Services and Community Services.

### SECTION III. PROCEDURAL RECOMMENDATIONS ADDRESSING QUALITY OF THE USER EXPERIENCE

*No Steering Committee action is needed.* These procedural recommendations stem from discussions by the Quality working groups and the persistent requests for modifications to the library from the user community in workshops and annual meetings. These recommendations will be incorporated into the overall quality enhancements to the library as appropriate to meet the user's needs. They will guide library development, but may not be strictly followed depending on how other parts of the library evolve and our knowledge and experience in library development expand.

#### **III.A. Developing an Earth system framework**

Through these recommendations, DLESE can create a framework that defines the scope of subject matter falling within the realm of Earth system education. Co-development of the Earth system vocabulary and framework using interdisciplinary teams of content, vocabulary, visualization, pedagogical, and grade level expertise is critical. As the framework develops, it will provide a mechanism for evaluating the depth and breadth of content in the library and can be used to guide accessioning of resources. The Earth system structural framework adopted will facilitate evaluating whether a resource belongs in the library and if so, it can help identify the linkages and relationships between the resource and other resources in the library. The structural framework and associated Earth system vocabulary will also provide a foundation on which to build a visual browser interface and higher order constructs that help users of DLESE understand relationships among Earth processes and concepts and begin to synthesize information to generate new relationships and understandings.

The purposes of creating an Earth system framework are as follows:

- To provide a means for linking resources in the library with concepts in Earth system education thereby enhancing their cataloging and retrieval by a diverse group of library users.
- To provide a more robust, operational definition of the scope of DLESE (i.e., what gets included, what doesn't).
- To identify the most important concepts about the Earth system and which of those concepts contributes to understanding the others.

- To offer a simple and intuitive mapping of the Earth system and the contents of the library.

This framework will provide infrastructure for new services such as thematic browsing and assembling sequences of resources for instruction. This framework has the potential to help users move from a disciplinary understanding of Earth to viewing Earth as a dynamic and integrated system. The cognitive advantage of providing information within a larger construct, which makes linkages between the user's existing knowledge and the new concept, has its roots in the cognitive science and human-computer interaction research on effective acquiring and processing of information.

Construction of this framework will be linked to construction of the vocabulary for Earth system and other relevant vocabularies. One can imagine this framework being integrated into the cataloging system, allowing catalogers or collection builders to see linkages between their resources and other content areas in the library. This framework is also useful for providing higher order visual interfaces for the user to explore the library resources and the realm of the Earth system visually. Just as scholars of language use lexicons and thesauri to research and better understand the complexity of a language, scientists and educators can use visual interfaces built upon this framework to explore the Earth.

#### *Recommending Teams*

Quality Working Group 1 and Quality Workshop User Experience and Metadata Teams

#### *Recommended Procedures for Developing the Earth System Education Framework*

Specific recommendations for implementation include:

- Development of the Earth system framework must be grounded in needs assessments and user studies.
- Visual and organizational structures, such as concept maps, with a range of small to large granularity, should be developed around key concepts in the Earth system to gradually explicate the scope of the library in operational terms. The granularity of the highest-level visual and organizational structures should be sufficiently large to allow completion in one year with infilling of finer granularity concepts and linkages continuing beyond that period. Development of the framework would be guided by the many existing resources available and would grow from pilot studies with community groups.
- The Earth system framework would incorporate knowledge of pedagogy and instruction.
- Linkages that show relationships and address gaps and overlaps must be made between the individual components of the Earth system framework.
- Development of the Earth system framework would be coordinated with development of the Earth system vocabulary.
- Development of the framework must be overseen by someone with expertise in visualization of complex relationships and or vocabulary development so that there is consistency in approach and a common vision is maintained through this process.
- Guidelines on how to construct components of the Earth system framework are developed and training for volunteer groups wanting to develop a component of the framework for their area of expertise is provided.

- Small, specialized teams would develop the individual components of the framework to ensure the accuracy of the science concepts and the relationships within the map and would coordinate with the larger framework development effort. Additionally, the group would ensure the language that represents the concepts reflects the diversity of broad audiences who use DLESE. These teams would have content and grade-level experts.
- Cataloging tools would be modified to support the Earth system framework in ways that allow easy determination of whether and where a resource fits within the framework, e.g. in what subject area and support effective cataloging.

### **III.B. Developing a Visual Browse Interface**

Working Group 6 identified a group of relevant visual browse interfaces based on their potentially high degree of application to Earth system education and DLESE. Interfaces examined reflect a breadth of approaches that are pertinent to DLESE users including sites based on science education standards, maps/geography, keywords, and "story telling." From these they began to construct criteria, which might guide development of the a visual browse interface. However, before embarking on any interface development, a comprehensive needs assessment and user studies should be conducted.

A visual browse structure has many advantages and limitations as outlined in the white paper by Working Group 6. Designed well, it can accommodate a variety of audiences by offering a visual structure that appeals to anyone seeking Earth system information. Ideally, the visual browse interface will combine visual information-seeking strategies for the audience whose information needs are either ill defined or well defined. The DLESE website should ideally be based upon a multi-faceted framework that describes how different facets of the Earth system are interrelated. It is important that the user maintains these relationships, and can actually *see* them, as placed within an overall context of the Earth system.

#### *Recommending Teams*

Quality Working Group 6 and Quality Workshop User Experience Team

#### *Recommended Procedures for Developing the Visual Browse Interface*

- Interface development should be closely tied with and develop in parallel with the plans for Earth system vocabulary and framework development in the effort to
  - ensure accurate coupling between concepts;
  - mirror those natural relationships within the Earth system, and realize them through appropriate computer graphic representations for the browse interface.
- Interface design should be able to accommodate the Earth system framework and vocabulary as they grow and evolve over time.
- Interface design should be flexible to allow for modifications to reflect changes in our understanding of the Earth.
- The visual interface should support users to understand where they are currently operating within the visual interface. Integration of a visual "you are here" cue will help the user better navigate complex relationships among Earth system concepts. The visual cue should not distract the use from their primary goals, but instead provide opportunities for "global" navigation/orientation.

### **III.C: Redesign the DLESE.org interface**

Community feedback indicates that the current DLESE.org user interface needs a to be redesigned to reflect DLESE as a project that brings together the best that the geoscience community has to offer for Earth system education. A significant effort must be put towards understanding the range of users and their needs before embarking on this effort, but it must start now. There are ongoing evaluation projects that can provide critical input but more is needed.

One of DLESE's valuable contributions to Earth system education can be in fostering projects and building community for educational reform. The library services must support the full vision of DLESE as a community catalyst. However, the change DLESE desires to catalyze through library interfaces can only occur in the classrooms, schools, museums and universities where dedicated scientists and educators propagate the ideas, techniques and resources that advance teaching and learning about Earth. Thus, DLESE.org must be well informed about user's educational needs and practices.

#### *Recommending Teams*

2004 Annual meeting strand groups 1, 9, 10, 11 and the quality mini workshop participants, 2003 Annual meeting participants, and the 2004 Quality Workshop User Experience and Partnerships groups

#### *Recommended Procedures for Enhancing the DLESE.org Interface*

- Evaluate the existing interface for its effectiveness in meeting the needs of current library users and the broader geoscience community we desire to attract to the site. Specific recommendations include making improvements to the site for new users and K-12 educators (more user friendly, easily accessible and less intimidating), increase recognition of partners and collections, and provide a more balanced presentation of services beyond the search engine.
- It is well documented that most users do not come to a site through the home page. Thus, the redesign of the site must take this behavior into account and ensure that users that arrive at the site through other means than the homepage know where they are and have access to a range of core library services.
- More prominently acknowledge individuals and projects making contributions as a reward for existing contributions and as an incentive for future contributions.
- Improve access to collections and portals, such as Using Data in the Classroom, the Evaluation Toolkit, the Earth Exploration Toolbook, and the Integrating Research and Education. These type of portals provide more than individual resources for teaching. These contribute critical elements that embody the concept of DLESE as a community center and provide services that can assist users in effectively using DLESE resources.
- Clearly identify in the search results the review status that each resource has achieved.

#### *Recommendations on Better Access to Collections in DLESE*

- Each collection's main webpage and all of its contents should be retrievable through a search on the collection's name.
- Search returns for resources in a collection should be structured to include the main URL for the collection included within the search return of any resource in that resource.

- Help collection builders provide more appropriate collections descriptions for the typical library user audience. These should include attribution to the creator and a link to the home site, when applicable.
- Improvements to both the display of the collection description and the content provided would make this information more valuable to the user.
- Browsing of the collections off DLESE.org should include a link to the main page of the identified collection when it exists.
- The current approach to recognizing collections and collection builders on the search results page is not scalable. With 19 collections today and many more to come, the current practice of listing all collections that include a particular resource in the search returns will soon become unmanageable. Highlighting the collection with the description that best matched a search or some other mechanism to indicate the collections containing the resource should be implemented.
- Collection developers have contributed a significant effort to DLESE and should be recognized, possibly under the About DLESE link on the main page. Links to the main page of the collection, and identifying the contributors is important for providing recognition of the collection builders and is aligned with our belief that having attribution on all resources and collections is another mechanism for determining quality.
- Continue to recognize the expertise of collection builders by including them in decisions about things that are relevant to them (e.g. metadata changes, tools development for cataloging) and greater representation on collections related committees.
- Devise ways to promote the work of collections developers at the annual meeting. Invite them to give presentations about their work as part of DLESE outreach at the annual meeting and beyond. Feature them in presentations about DLESE. Consider how contributing to DLESE can be a benefit to them.
- Investigate methods to increase visibility of and accessibility to annotations and annotation collections.
- The web analytics community is developing methods and procedures for more fine-grained information gathering on user behaviors. DLESE should incorporate these types of mechanisms in the library.

### **III.D: Provide tools to submit and access all informal and formal community input on resources**

#### *Recommending Teams*

Strand groups 1, 2, 10, 11 and the quality mini workshop participants

#### *Recommended Procedures for Providing Access to and Submitting Ratings, Reviews and Comments on Resources*

DLESE will investigate methods for increasing the ease and utility of rapid informal feedback and resource recommendations. This effort needs to be informed by user studies in progress and future studies. Table 1 shows the status of community input features in the library. The idea of providing rapid, informal feedback using a quick rating system designed along the model of Amazon.com customer ratings has been popular with the DLESE community for years. Also, the community has asked for an opportunity to provide comments or teaching tips with no rating in a belief that these would increase the efficiency of choosing resources for the classroom. Still other

community members want a mechanism that will recommend similar resources once a user has chosen a relevant resource. Finally, the community has requested a means for recommending a resource be removed from the library. Often the community has recommended that these features are accessible with an icon on the search results page. Development work on these features continues.

Table 1: Forms of user comment, reviews, and ratings requested by the community

Service	Current Status
Formal review of a resource	Implemented via the Community Review System, as a link off the search results page on all instructional resources in the DLESE Collection, except if resource creator opts out.
Informal comments or teaching tips	Fully implemented as a link off the search results page for all resources in the DLESE Collection.
Recommend a resource	Available as a link under the Educational Resources Tab, and as a link from the lower right hand corner of dlese.org front page.
Remove (reconsider) a resource	Available as a link under the Educational Resources Tab. Soon to be accessible via a checkbox on the Comments or Tips page.
Recommend a link between resources	Not available. Planned in limited form for links to pedagogical resources that help a teacher use an earth system resource.
Informal ratings of resources	Not available.

### **III.E: Explore Mechanisms for Facilitating Collaborations**

In the Community Plan it was advocated that DLESE could actively assist resource development efforts by facilitating access to technical and educational specialists. A second important element in the library is active support for special interest groups to pursue their interests in a collaborative development environment. DLESE's greatest asset is the wealth of knowledge and skills in the community. Encouraging groups with special interests to self-organize to develop tools, collections or services supporting their needs is a critical step for maintaining an active community and cutting edge library. Requests for facilitating collaborations within DLESE are common across all user groups. Many mechanisms have been suggested and all have their strengths and weaknesses. This lack of understanding of what works and what is really needed has hampered DLESE's and other community based efforts in this area (Giersch, 2004).

#### *Recommending Teams*

2004 Annual Meeting Strands 2, 4, 7, 8

#### *Recommended Procedures for Facilitating Collaborations in the Library*

DLESE should investigate options and conduct a needs assessment to better understand what is feasible and effective for facilitating collaborations in a digital environment.

### **III.F: Personalization of DLESE**

As with the request for collaboration services, DLESE community frequently has requested personalization services in the library. These might include developing a “My DLESE” option similar to many commercial service-oriented sites to allow assembly of lesson plans, curriculum units etc.

#### *Recommending Teams*

2004 Annual Meeting strands 1, 5, 9, and the quality discussion session

#### *Recommended Procedures for Facilitating Personalization Services in DLESE*

- Conduct a needs assessment to fully understand what types of services are desired before development begins within DLESE.
- Continue to seek partnerships with developers of personalization services and explore the range of options.

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<sup>i</sup> Participant interaction in digital libraries: A workshop report, S. Giersch, G. Klotz, B. Muramatsu, et. al. 2004, <http://pidlworkshop.comm.nsdlib.org>