The National Dam Safety Program

Research Needs Workshop: Impacts of Plants and Animals on Earthen Dams

FEMA

Preface

One of the activities authorized by the Dam Safety and Security Act of 2002 is research to enhance the Nation's ability to assure that adequate dam safety programs and practices are in place throughout the United States. The Act of 2002 states that the Director of the Federal Emergency Management Agency (FEMA), in cooperation with the National Dam Safety Review Board (Review Board), shall carry out a program of technical and archival research to develop and support:

- improved techniques, historical experience, and equipment for rapid and effective dam construction, rehabilitation, and inspection;
- devices for continued monitoring of the safety of dams;
- development and maintenance of information resources systems needed to support managing the safety of dams; and
- initiatives to guide the formulation of effective policy and advance improvements in dam safety engineering, security, and management.

With the funding authorized by the Congress, the goal of the Review Board and the Dam Safety Research Work Group (Work Group) is to encourage research in those areas expected to make significant contributions to improving the safety and security of dams throughout the United States. The Work Group (formerly the Research Subcommittee of the Interagency Committee on Dam Safety) met initially in February 1998. To identify and prioritize research needs, the Subcommittee sponsored a workshop on Research Needs in Dam Safety in Washington D.C. in April 1999. Representatives of state and federal agencies, academia, and private industry attended the workshop. Seventeen broad area topics related to the research needs of the dam safety community were identified.

To more fully develop the research needs identified, the Research Subcommittee subsequently sponsored a series of nine workshops. Each workshop addressed a broad research topic (listed below) identified in the initial workshop. Experts attending the workshops included international representatives as well as representatives of state, federal, and private organizations within the United States.

- Impacts of Plants and Animals on Earthen Dams
- Risk Assessment for Dams
- Spillway Gates
- Seepage through Embankment Dams
- Embankment Dam Failure Analysis
- Hydrologic Issues for Dams
- Dam Spillways
- Seismic Issues for Dams
- Dam Outlet Works

In April 2003, the Work Group developed a 5-year Strategic Plan that prioritizes research needs based on the results of the research workshops. The 5-year Strategic Plan ensures that priority will be given to those projects that demonstrate a high degree of

collaboration and expertise, and the likelihood of producing products that will contribute to the safety of dams in the United States. As part of the Strategic Plan, the Work Group developed criteria for evaluating the research needs identified in the research workshops. Scoring criteria was broken down into three broad evaluation areas: value, technical scope, and product. The framework adopted by the Work Group involved the use of a "decision quadrant" to enable the National Dam Safety Program to move research along to produce easily developed, timely, and useful products in the near-term and to develop more difficult, but useful, research over a 5-year timeframe. The decision quadrant format also makes it possible to revisit research each year and to revise research priorities based on current needs and knowledge gained from ongoing research and other developments.

Based on the research workshops, research topics have been proposed and pursued. Several topics have progressed to products of use to the dam safety community, such as technical manuals and guidelines. For future research, it is the goal of the Work Group to expand dam safety research to other institutions and professionals performing research in this field.

The proceedings from the research workshops present a comprehensive and detailed discussion and analysis of the research topics addressed by the experts participating in the workshops. The participants at all of the research workshops are to be commended for their diligent and highly professional efforts on behalf of the National Dam Safety Program.

Acknowledgments

The National Dam Safety Program research needs workshop on the Impacts of Plants and Animals on Earthen Dams was held on November 30-December 2, 1999, in Knoxville, Tennessee.

The Department of Homeland Security, Federal Emergency Management Agency, would like to acknowledge the contributions of the Association of State Dam Safety Officials and Dr. B. Dan Marks, Dr. Bruce Tschantz, David K. Woodward, Charles Clevenger, and William Bouley in organizing the workshop and developing these workshop proceedings. A complete list of workshop facilitators, presenters, and participants is included in the proceedings.

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Introduction & Scope of Project

Introduction and Scope of Project

The research project associated with plant and animal penetrations of earthfilled dams was proposed through the Interagancy Committee on Dam Safety (ICODS) Subcommittee on Dam Safety Research. The project was subsequently submitted through ICODS for funding by the Federal Emergency Management Agency (FEMA). The project was funded by FEMA with a contract administered through the Association of State Dam Safety Officials.

The Steering Committee for the Plant and Animal Penetrations of Earthfilled Dams Project was comprised of representatives from ASDSO, academia, private practice, state agencies, and federal agencies.

The scope of work or purpose of the research project as set forth in the agreement between FEMA and ASDSO was to identify dam safety state-of-practice issues and research needs relative to plant and animal penetrations of earthfilled dams. The purpose of this project was to be accomplished through the achievement of five objectives, which include the following tasks:

1. Conduct literature searches and surveys to determine state-of-practice issues and research needs.

2. Organize and conduct an invited-participant state-of-practice and research needs workshop.

3. Publish a proceedings of the presentations made at the workshop.

4. Publish a project report to be submitted through ICODS to FEMA.

The workshop on Plant and Animal Penetrations of Earthfilled Dams was conducted November 30-December 2, 1999 at the University of Tennessee Conference Center in Knoxville, Tennessee. The workshop was a successful undertaking that opened communications between the dam safety and wildlife communities.

Executive Summary

Executive Summary of Project

Item 1. Summary of Data Collection Process and Workshop

Pre-Workshop Data Collection

The data collection process was identified early on as the key to successfully completing the project. Some of the questions asked in the initial stages included:

1. What is known about the impacts of plants and animals on dams?

2. What kinds of policies or procedures are being followed by regulatory agencies (state or federal) for dealing with plants and animals on dams?

3. How can the gaps in knowledge or technology that prevent dam owners or regulators from developing effective methods to control plant and animal damage to dams be identified and addressed?

In order to collect as much information as possible on this topic, several literature reviews and surveys were completed. ASDSO Information Specialist Sarah Mayfield conducted a search for sources of information on plant or animal impacts on dams. The resulting bibliography included references from the following sources: the American Society of Civil Engineers (internet database), the Association of State Dam Safety Officials (newsletter articles and conference proceedings), the Canadian Dam Safety Association (conference proceedings), and several state and federal agencies (technical notes/fact sheets/guidelines).

In addition, Dr. Bruce Tschantz of the University of Tennessee and David K Woodward of North Carolina State University undertook independent searches of university databases and other sources of information on plant and animal impacts on dams. Dr. Tschantz compiled a significant number of references from some of the same sources listed above, as well as from the National Technical Advisory Service (NTIS) and the National Performance of Dams Program (NPDP). His bibliography includes references on the general physiology and character of woody plants, documented case histories of problems attributed to woody plants on dams, as well as current research activities involving the effects of woody plants on dam safety.

Mr. Woodward consulted Water Resources Abstracts and the Agricola Database, as well as the sources used by Dr. Tschantz. His bibliography includes references on the habits of burrowing animals; case studies of animal-caused damage to embankments and spillways; agency practices for preventing, controlling and repairing such damage; and related research activities.

In addition to the bibliographic searches, a large number of dam safety specialists were given the opportunity to contribute to the "body of knowledge". Surveys were developed to extract information from different groups, asking them to describe their experiences with plants and animals on dams. Primarily, the committee wanted

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Item 1. Summary of Data Collection Process and Workshop

to know the following:

What types of policies or operating procedures are being utilized by regulators facing problems with the management of plants or animals on dams, and, if no policy or procedure exists, then what recommendations are regulators making to dam owners concerning such problems?

What legal, financial, environmental or other constraints apply to the resolution of impacts made by plants and animals on dams.

In addition, the survey respondents were asked to supply the following:

Documented evidence where plant or animal impacts have negatively impacted the operation of a dam, or contributed to its failure, and

References to research projects or discussions already completed or underway regarding the effects of plants or animals on dams.

Surveys were distributed to all state dam safety regulatory staffs, all federal agencies with dam safety responsibility (through their ICODS representatives), and to several dam owners and consultants (through the ASDSO Affiliate Advisory Committee). Responses were received from 48 states, 11 federal agencies, and four representatives of the private sector. The detailed survey response data was compiled and can be viewed in sections One and Two of the attached workshop proceedings.

Key results of the surveys include the following:

All state dam safety officials consider trees and plant growth on dams to be a safety problem. Further, both state and federal officials generally agree that trees in particular have no place on dams.

The problem most commonly noted by state officials is that trees, woody vegetation, briars, and vines on dams interfere with effective safety inspections.

Twenty four of the 48 responding states do have either a formal policy or operating procedure for addressing tree and woody plant growth issues. Of the remaining 24 states that do not have a formal policy or procedure, the range of recommended procedures to dam owners varies widely.

The greatest constraint to having unwanted trees and plants removed and repairing a structure infested with roots is the limited financial capacity of the dam owner. The second most listed constraint was environmental regulations, such as limitations on the use of herbicides, or the prohibition of burning vegetation.

Twenty-nine states have documented evidence where vegetation on dams has either caused dam failure or negatively affected their safe operation.

The most severe problem impacting the integrity of dams caused by animals is the burrowing into

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Item 1. Summary of Data Collection Process and Workshop

embankments by muskrats, beavers, and woodchucks. The next most significant problem is clogging, or the obstruction of hydraulic structures and spillways.

The seepage and piping caused by such burrowing or tunneling activities by animals have resulted in documented dam failures.

For animals the most successful abatement method, cited by at least 40 states and nine federal agencies, is trapping (including live trapping and relocation of the animals). Additional procedures cited include habitat alteration, exclusion (such as fencing and filters), hunting, and toxicants.

Controlling vegetation and animal populations on or near dams can be an expensive and time-consuming activity, but the cost of control methods pales in comparison to the potential cost of repairing neglected dams that have been damaged by plant and animal penetrations.

Literature Review

The literature review yielded several references on federal and state practices, policies, and procedures for dealing with trees and vegetation, but few research reports.

The literature search yielded documentation of numerous cases of animals causing damage to embankments and spillways, and various procedures for dealing with the problem, but little in the way of research.

Workshop Results

Another component of the project, the Specialty Workshop on Plant and Animal Penetrations on Dams, fulfilled an objective of the original project scope of work, and was designed to complete the data collection process. The steering committee's goal was to bring together a group of experts with experience in all aspects of the issue for more in-depth, face-to-face discussions. The participants included state and federal regulators, dam owners, academics, and private industry representatives. All had either had direct experience dealing with the impacts of plants and animals on dams, had researched the issues, or were developing potential solutions to the known problems. In addition to the broad range of expertise, the participants also represented all regions of the U.S., ensuring that all types of animals, vegetation, climates, and structures were included in the study.

The workshop was held November 30 to December 2, 1999 in Knoxville, Tennessee. The twenty-two invited participants each made a 30-60 minute presentation summarizing their experiences or research relating to plant or animal impacts on dams.

Key findings from the workshop include the following:

All types of dams (large, small, earthen, and concrete), and their appurtenant structures are vulnerable to safety problems caused by plants and animals.

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Item 1. Summary of Data Collection Process and Workshop

While all dam safety regulatory agencies are aware of the problems associated with plant and animal penetrations on dams, some can take a stronger enforcement stand on prevention and elimination, while others are more limited by financial, environmental, or legal constraints.

Tools, technology and methods are available to help regulators and owners identify, prevent and mitigate problems with plants and animals on dams. Information on the most effective tools should be compiled and distributed to those responsible for the safety of the dams.

The impacts of vegetation on dams and the effectiveness of treatments to inhibit the growth of plant roots on dams are the two areas where further research is most needed. Not enough scientific information is available to determine what the acceptable level (amount, size) of vegetation on dams should be; and more facts are needed about how the currently recommended damage mitigation and repair methods work.

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Item 2. What is the State of Practice?

In the years since this issue was first studied, dam safety regulators (and some dam owners) have become more educated about the safety problems caused by animals and vegetation on dams. Not only is there more knowledge, but also more agreement about the need to prevent and repair damage caused by plants and animals on dams. Specifically, dam safety officials and experts agree that vegetation and animals need to be managed and controlled on both existing and new dams for these important reasons:

(1) Woody plants and dense vegetation (and in some cases, animals) hinder effective dam inspections; and

(2) Tree roots and animal burrowing can cause serious structural instability or hydraulic problems with dams, which could lead to dam failure.

However, the "state of practice" is somewhat fragmented and inconsistent among the responsible parties. On the regulatory side, a significant range of differences exists among state and federal agencies with respect to treating the plant and animal problems. Some state agencies have no official policy on the issue and treat each case individually, while other states, and almost all federal agencies have a "zero tolerance" rule, especially with respect to large trees on dams. Most state policies on vegetation fall somewhere in the middle, allowing certain levels of vegetation (i.e. shrubs or small trees only), or requiring the cutting of live trees but allowing tree stumps to remain, etc. Policies on the treatment of animal impacts are mostly inconsistent.

Regarding vegetation/animal management and control, several factors seem to contribute to the fragmentation of the current state of practice. One is that the diversity of problems, and the types of plants and animals that cause them, seems to widen by the day. Climate and geography determine what types of trees will grow and what types of animals will invade dams in different parts of the country. For example, while beavers and muskrats seem to cause problems everywhere, animals such as crayfish, armadillos, and gopher tortoises would only be a concern in very specific areas. Additionally, geological factors such as soil types and conditions, and groundwater levels will result in different growth patterns of tree roots.

Finally many dam owners and state regulators are unaware of what resources are available to help with these problems. Better communication between organizations would for instance, allow owners to take advantage of USDA programs to help deter or remove animals that cause property damage, or to follow research on herbicides being conducted by the US Bureau of Reclamation. State regulators would also benefit by learning what damage prevention and repair methods have been tried successfully by other state programs.

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Item 3. What are the Future Research or Development Needs?

Summary of Research Needs:

It was concluded that through studying case histories and conducting field studies, vital information on the impacts of trees and other vegetation on dams could be collected. This information is needed to help regulators determine what (if any) vegetation should be allowed on or near dams.

The second area of research relates to the treatment of roots. Workshop participants learned about chemical/herbicide treatments that are being used by the USBR to deaden roots, as well as some barrier substances that can be used to prevent root growth into unacceptable areas. Studies of these and other possible methods of root control are needed to determine what works and what doesn't.

Summary of Development Needs:

Several areas for future development were identified by the group. The first is characterized by education. Tools are needed for educating dam owners and engineers on how to spot problems caused by plant and animal penetrations, how to prevent these problems from occurring, and how to mitigate (or repair) existing problems.

Specific ideas include the development of a booklet for dam owners with information on why plants and animals should be kept off dams, how to remove and manage animals and plant growth, and a list of resources for aiding owners with these types of problems. Both a manual and a training seminar have been proposed which would provide dam owners and engineers with design guidelines for preventing plant and animal problems on dams, and maintenance guidelines for removing or mitigating existing problems.

It was also determined that a booklet is also needed to train regulators and staff, especially dam inspectors, how to identify animal and vegetation problems that threaten the safety of a dam.

The experts propose that tools and methods for repairing animal burrows on dams be analyzed for their effectiveness in different situations, and that new tools and methods be developed where needed.

Finally, the experts determined that collaboration with other groups (such as federal wildlife agencies) that have research programs in place should be a part of this development process.

Results

Results

Item 1. Literature Review and Current Research

Woody Vegetation

Few citations to woody-plant-related research were identified by any of the three groups surveyed. The reference most often cited was the *University of Tennessee Tree Growth Report* (Tschantz, 1988). The Corps of Engineers referred to the technical report series, *Repair-Evaluation-Maintenance-Rehabilitation (REMR)* on research conducted at the Waterways Experiment Station.

The literature review yielded several references on federal and state practices, policies, and procedures for dealing with trees and vegetation, but few research reports.

Workshop presentations on current research in this area included *Biobarrier: A Long-Term Root Control System,* by William Hawkins; *Control Methods for Woody Vegetation*, by David Sisneros; and *Engineered to Fail? Tree Root Management on Dams*, by Dr. Kim Coder.

Animal Impacts

Those surveyed referred to numerous instances where animals affected the safe operation of dams and/or caused dam failure. Few knew of any research in this area. The following documents/studies were among those mentioned:

Hegdal, Paul L. and Harbour, A.J., Prevention and Control of Animal Damage to Hydraulic Structures*, U.S. Bureau of Reclamation and U.S. Department of Agriculture, 1991.*

Hygnstrom, Scott; Timm, R.M. and Larson, Gary E. (eds), Prevention and Control of Wildlife Damage, Nebraska Cooperative Extension Service*, University of Nebraska and U.S. Dept of Agriculture, 1994.*

Tschantz, Bruce A. and Weaver, Jess D., Tree Growth on Earthen Dams: A Survey of State Policy and Practice*, 1988.*

unspecified research by the USACE Waterways Experiment Station

Oklahoma Bulletin No. OK210-0-3, Evaluation of Beaver Control Trials *(1989)*

Haggard, David W. and Dominick, Max D., Evaluation of Beaver Guards on Restricted Flow Risers of SCS-Assisted Floodwater Retarding Structures in Oklahoma*, USDA/SCS, 1989.*

The literature search yielded documentation of numerous cases of animals causing damage to embankments and spillways, and various procedures for dealing with the problem, but little in the way of research.

Reports on current research in the field were presented at the workshop by Matthew Barner (The Use of Ground-Penetrating Radar, Electrical Resistivity, and Streaming Potential to Assess Damage by Burrowing Animals to Three Selected Portions of Earthen Levees Near Dayton, Ohio) and Jim Miller (Wildlife Damage to Earthen Dams, Dikes, Levees, and Related Structures).

Results

Item 2. Workshop Issues Development and Prioritization

In the interest of collecting as many ideas as possible, but yet, preparing a workable list of possible topics, a special process was developed and used in the workshop. This process was a variation of the Strategic Planning Process known as MetaPlan developed by the IBM Corporation (see Appendix 3 for an explanation of the process).

Question to Resolve

The question developed for attendees to address:

What are needed developments to feel comfortable when dealing with woody vegetation and animals associated with dams?

The question is intended to be specific to the desired outcome, but somewhat vague so as to not influence input into predetermined categories.

Prioritizing the Categories

Individuals are asked to define their own priority (importance) for the categories using a multi-vote. All votes are counted for each category. This voting creates a typical Pareto distribution of the categories.

Participants were also asked to rank difficulty. This is an estimate as to how difficult items in a any particular category may be. Difficult may mean expensive, technically challenging, complex, or any context, which the participant chooses for any given category. In this case each participant gives EACH category a score of 0 to 10, with 0 being easy and 10 being very difficult. Scores are then averaged. Final results for importance and difficulty are shown in the table below.

Table 1 - Categories, Items and Scores

Category	Importance # (From 1-25)	Difficulty (Avg) (from 1-10)
A DESIGN GUIDELINES	7	4.25
1. Determine design prevention measures		
2. A buffer zone minimum of 30 ft for deep rooted vegetation		
3. Develop an engineering guide to establish barrier system		
4. Allowable proximity of desert trees to dams		
5. Different animals in different parts of U.S.		
6. Do not limit discussion to “woody” vegetation		
B P&A MANAGEMENT OR CONTROL	14	5.33
1. Determine mitigated measures		
2. Kudzu, how to get rid of it		
3. Develop animal damage control techniques for aquatic vs. land animals		
4. Recommended repair methods for deep animal burrows		
5. Habitat alteration		
6. Other dam upgrades with tree removal		
7. Tree stump removal methodology		

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Item 2. Workshop Issues Development and Prioritization

Category	Importance #	Difficulty (Avg)
C RESEARCH & DEVELOPMENT	25	6.66
1. What are the interactions between plant/tree development and the phreatic surface?		
2. Rate of root decay		
3. Burrow data		
4. Tree root data		
5. Research of root development pre & post treatment of control methods		
6. How do different tree species roots develop on dam slopes		
7. Establish more definitive guidelines/technology on tree root penetration		
8. Develop barrier methods for targeted animals		
9. Research vegetation that might act as animal repellent		
10. Research to determine methods to keep animals out of earthfilled dams		
11. Best method for removing animals from dams		
12. Brush root growth limits (understanding of)		
13. Impacts of plants & animals on weak zones such as cracks		
14. Growth limits		
15. Acceptable size of root left in a dam		
D INFORMATION RESOURCES	19	4.5
1. A concise, well illustrated bulletin or handbook for field use by inspectors, that is weatherproof and practical.		
2. What to look for re P & A…..		
3. Determine extent of general problem		
4. ASDSO session on P & A penetration issues		
Expand reference sources/network for up to date information, e.g. herbicides, wildlife damage, soil renovation techniques, etc.		
5. Determine species of concern across U.S.		
6. State inservice training involving other disciplines, and expertise from a variety of sources, e.g. state DNR, CES, others		
7. Explain current technology for non-scientists regarding control methods for trees/animals		
8. Provide technical training relative to plant/animal dam Penetrations		
9. Establish tech transfer mechanisms (e.g. the web)		
10. Need to look at levee experience		
11. Establish database structure		
12. What lessons can be learned about trees/animals on dams from Europe & Asia?		
13. Dam failure case histories		
14. Send NPDP your slides for posterity		
15. State of riser and drain dam design		
E OPERATION & MAINTENANCE	6	4
1. More frequent inspection schedule for animal burrowing		
2. Recommendation for frequency of mowing dam embankments		
3. Recommendation for frequency (minimum) of inspections (periodic) by owner or owner's representive		

Results

Item 2. Workshop Issues Development and Prioritization

Category	Importance #	Difficulty (Avg)
F. FUNDING 1. Money for funding remediation/repair	2	5.72
G. VALUE ENGINEERING 1. Develop cost models for P & A mitigation 2. Evaluate cost impact of P & A on dams 3. Value engineering methods for deep burrow repair (what is least expensive & beneficial repair method)	1	6
H. INDUSTRY PRODUCTS 1. More input from industry products 2. Pesticides, p&a 3. Materials that are non-penetrable by animals 4. Chemical limits	1	3
I. INTERORGANIZATIONAL COOPERATION 1. Cooperative efforts between private/state groups to assist in dam repairs 2. A trust relationship between owners and dam safety officials 3. Develop cooperative relationship between USDA state extension & ASDSO	1	6
J END USER AWARENESS 1. Owner belief in proactive rodent and woody vegetation control 2. We need to develop effective awareness/education tools for owners about the problems and management of plants/animals on trees 3. Develop owner maintenance manual 4. Develop dam owner guidelines for plant (tree) damage control 5. Develop dam owner guidelines for animal damage control assistance 6. Develop an owner guide for dealing with P & A 7. Develop cases/proof tools - why p&a are bad 8. Develop guidelines for removal of woody vegetation from dams, for owners 9. Owner responsibility 10. Mention that problems associated with animals and trees are recurring, not onetime problems 11. Develop method for educating dam owners of the need to keep woody vegetation off dams 12. Develop method for educating dam owners of the need to keep burrowing animals out of dams 13. Develop information pamphlet for chemical removal of woody vegetation on dams for dam owners	22	6.5
K. POLICY & REGS 1. Uniform policy across states 2. Policy for removal of animals 3. Policy for repairing areas where animals have been removed 4. Policy for repairing areas where trees have been removed 5. Existing dams policy: Remove all trees and bushes	7	8

Results

Item 2. Workshop Issues Development and Prioritization

Category	Importance #	Difficulty (Avg)
6. New dams policy: No trees or bushes! Ever! Period. 7. Establish a criteria for size & method of removal of vegetation on dams 8. Use of IPM/BMP 9. Regulatory guidance: EPA, FW, DS 10. Determine where important in dam safety and maintenance		
L. INVESTIGATIVE TECHNIQUES 1. An accurate method of mapping burrow systems 2. Better ways to detect leakage from plants/animal penetrations 3. Means to animal location/presence 4. Investigate barrier methods	10	7
M. PUBLIC RELATIONS 1. PR stuff to give public 2. Language understood by all 3. Being responsible to animal rights 4. Acceptable public animal control 5. Guidelines for dealing with “anti”s	6	5
N. LEGAL ISSUES 1. Animal/plant caused failure liability 2. Publicize danger of plant/animal penetrations relative to dam safety 3. Liability 4. Owner liability regarding A&P damage leading to dam failure	2	8

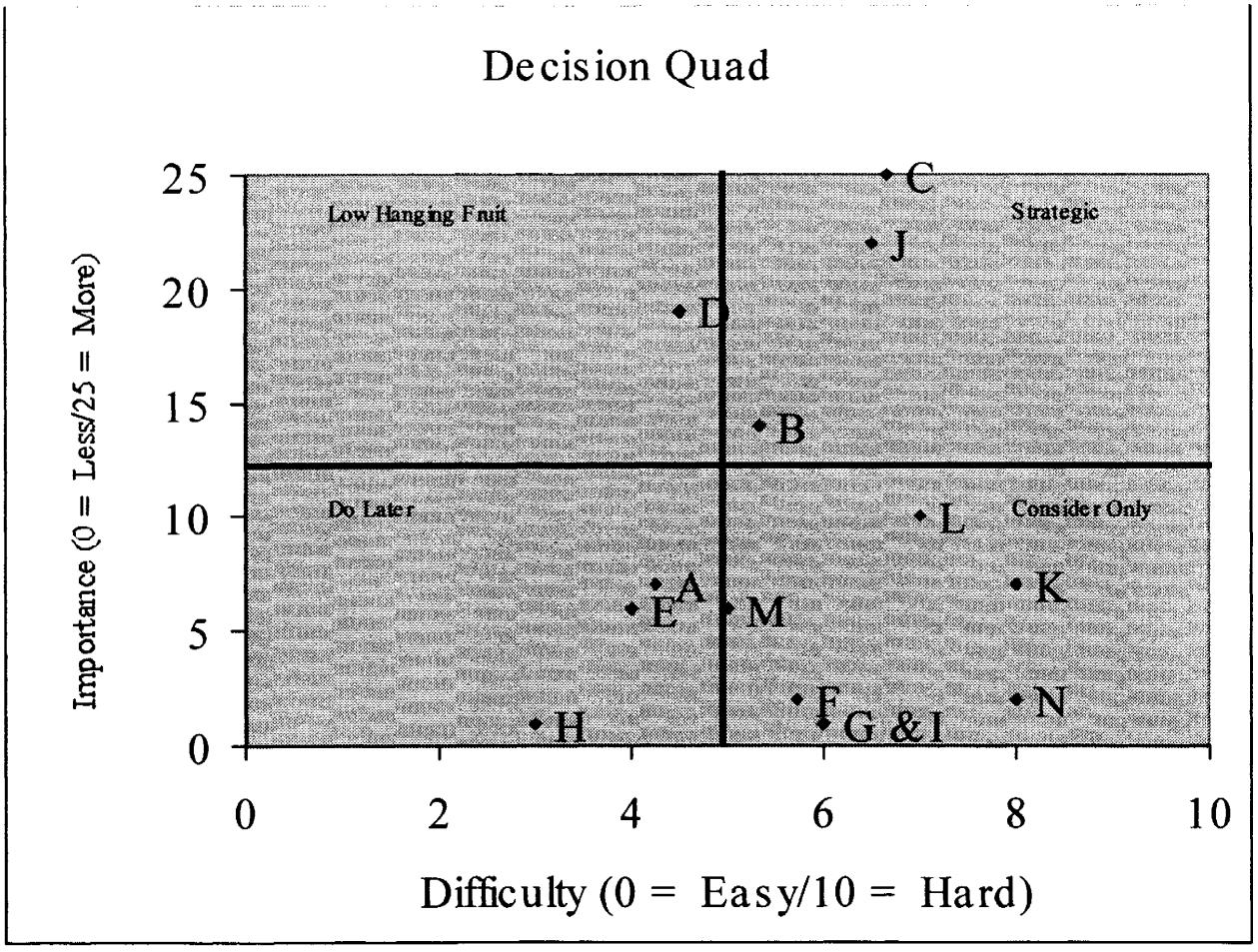
Using both types of data, a "decision quad" of the data was produced. The quad is formed by four quadrants in the data, each of which is given a descriptive name.

Quad : Easy and important : Low Hanging Fruit

Hard and important: Strategic Items

Easy but less important: Do later .

Hard and less important: Consider



Results

Item 3. Topics Developed for Future Research and Development Projects

Based on the issues developed and subsequently prioritized, workshop participants were askedto submit siggested research and development projects. Below is a sample of the form used by the participants to record their project ideas. Following the sample are copies of the completed forms as submitted by the workshop participants. The ideas therein constitute the research and development "deliverables" resulting from the workshop.

Survey on Research Pertaining to
Animal and Vegetative Impacts on Earthen Dams

1. Title/Description of Research Item:

2. Description
   A. Why is this a priority research item?

   B. What is the expected outcome?

3. Project Tasks and Needs
   A. What tasks are to be done?

   B. How is the problem to be solved?

4. Project Lead and Contact
   A. Who is working in this area?

   B. Who might be able to lead the project?

   C. Who are good candidates to complete the work?

Results

Item 3. Topics Developed for Future Research and Development Projects

1. Title/Description of Research Item:

Root Longevity Pre/Post Development Following Various Control Methods

2. Description

A. Why is this a priority research item?
B. What is the expected outcome?

Based on presentations it seems that very little is known on what happens to roots on trees/brush on dams that have had some type of control conducted on them. Do roots of treated plants pose a problem to dams if not removed, covered with soil? The research item would give information regarding decay rates, (void development, soil types, PH) of roots following treatment.

3. Project Tasks and Needs

A. What tasks are to be done?
B. How is the problem to be solved?

Specific dams and sites could be located containing various types of dediduous, evergreen and shrubs/trees. Current controls could be applied to this vegetation and then monitored over a period of years. The observation period would need to be over a prolonged period of time based on soil types, rainfall and geographic location. It is possible that chemical agents other than herbicides could be added to the treated trees/brush to accelerate the decaying process. Labeled trees and brush could then be periodically unearthed to determine rates of decay. This work could potentially be conducted away from dam sites in small case studies which would mimic actual sites.

4. Project Lead and Contact

A. Who is working in this area?
B. Who might be able to lead the project?
C. Who are good candidates to complete the work?

I don't know of anyone working in this area. Dr. Marks would probably be able to lead this project.

Results

Item 3. Topics Developed for Future Research and Development Projects

1. Title/Description of Research Item:

Plant and Animal Problems with Dams Booklet

2. Description

A. Why is this a priority research item?
B. What is the expected outcome?

Very important to educate dam owners about problems with penetrations and why we need to prevent and mitigate them. A booklet I can give to John Q. Dam-owner which clearly defines the problem, liabilities and corrective measures.

3. Project Tasks and Needs

A. What tasks are to be done?
B. How is the problem to be solved?

Current state-of-practice must be defined. Broad, general policies need to be developed, i.e. trees on dams are unacceptable. Research areas must be defined. A booklet or web-based document should be developed and made available.

4. Project Lead and Contact

A. Who is working in this area?
B. Who might be able to lead the project?
C. Who are good candidates to complete the work?

ASDSO, in conjunction with the BuRec and NRCS and private sector experts. A cross-agency workgroup.

Results

Item 3. Topics Developed for Future Research and Development Projects

1. Title/Description of Research Item:

Research and Development – Allowable Proximity of Trees to Dams

2. Description

A. Why is this a priority research item?
B. What is the expected outcome?

Dam failures have been attributed to tree impacts at dams.

3. Project Tasks and Needs

A. What tasks are to be done?
B. How is the problem to be solved?

Evaluate actual impacts of trees (various species) adjacent to both water storage dams and flood control (dry) dams. Research needs to include field investigations, compilation of case histories, and recommendations developed from research.

4. Project Lead and Contact

A. Who is working in this area?
B. Who might be able to lead the project?
C. Who are good candidates to complete the work?

Recommend large organization such as ASDSO or federal agency research this in cooperation with all having interest in dam safety.

1. Title/Description of Research Item:

Development of Procedures for Repair of Animal Burrows in Dams

2. Description

A. Why is this a priority research item?
B. What is the expected outcome?

Dam failures have been attributed to animal burrows.

3. Project Tasks and Needs

A. What tasks are to be done?
B. How is the problem to be solved?

Evaluate different impacts by animals known to burrow on dams. Repair procedures to be developed for specific animal impacts, i.e., beaver dams, ground squirrel burrows. Procedures may require dam owner to determine site-specific impacts before selecting repair method.

4. Project Lead and Contact

A. Who is working in this area?
B. Who might be able to lead the project?
C. Who are good candidates to complete the work?

Large organization involved with dam safety such as ASDSO.

1. Title/Description of Research Item:

Manual for Minimizing Negative Impacts of Vegetation and Animals on Earth Embankment Dams

2. Description

A. Why is this a priority research item?
B. What is the expected outcome?

Write manual which 1) provides design guidelines for preventing or minimizing the occurrence of vegetative and animal problems, and 2) provides maintenance guidelines for removing and mitigating the impacts of existing problems due to vegetation and animals.

3. Project Tasks and Needs

A. What tasks are to be done?
B. How is the problem to be solved?

Determine extent of problem (plants and animals)
Determine current methods for dealing with problems
Write manual and publish
Provide training

4. Project Lead and Contact

A. Who is working in this area?

B. Who might be able to lead the project?

C. Who are good candidates to complete the work?

Results

Item 3. Topics Developed for Future Research and Development Projects

1. Title/Description of Research Item:

ASDSO Regional Training Seminars "Plant and Animal Penetrations of Earthen Dams"

2. Description

A. Why is this a priority research item?
B. What is the expected outcome?

This topic categorized as a strategic activity that with some difficulty can be accomplished with or by use of the workshop manual to be developed from workshop. Engineer and owner awareness will be the desired outcome.

3. Project Tasks and Needs

A. What tasks are to be done?
B. How is the problem to be solved?

Proposals will be developed to present both regional and specialty training seminars to be sponsored through ASDSO.

4. Project Lead and Contact

A. Who is working in this area?
B. Who might be able to lead the project?
C. Who are good candidates to complete the work?

Dr. B. Dan Marks, S & ME, Inc.

Dr. Bruce Tschantz, UTK

David K. Woodward, NCSU

Charles Clevenger, MS

Dr. Nale Nolte, USDA-APHIS

Results

Item 3. Topics Developed for Future Research and Development Projects

1. Title/Description of Research Item:

Develop Two Types of Owner Brochures for States:

1. Why keep trees and brush off dams?

2. How to remove and manage trees and brush on dams.

2. Description

A. Why is this a priority research item?
B. What is the expected outcome?

The dam owner needs information, and the state dam safety field people need reinforcement about why trees and brush have no place on dams. Also guidance on removing, managing and preventing such growth in order to help inspectors and to prevent potential failures.

3. Project Tasks and Needs

A. What tasks are to be done?
B. How is the problem to be solved?

Review and compile existing literature,, state survey data, failure cases, state and federal procedures/policies to give rationale, basis.

Develop a tri-fold, slick, colored brochure for states to give to owners. Allow space on manual for a given state to stamp their contact names, telephone numbers, address, etc. for obtaining additional information.

4. Project Lead and Contact

A. Who is working in this area?
B. Who might be able to lead the project?
C. Who are good candidates to complete the work?

B. Tschantz, University of Tennessee, (trees/plants); with a couple of state officials and consultants assisting. (C. Clevenger, D. Marks)

D. Woodward, NCSU (Also suggest a parallel set of brochures on animals.)

1. Title/Description of Research Item:

Research Practice Manual on Use of Chemicals, Bio-barriers in Dam Applications

2. Description

A. Why is this a priority research item?
B. What is the expected outcome?

This product technique, which seems to be well-established for gen landscaping applications, has apparent promise for controlling trees/brush on earthen dams and at various other appurtenant structures associated with all types of dams. Such controls could eliminate potential tree & brush problems on dams.

3. Project Tasks and Needs

A. What tasks are to be done?
B. How is the problem to be solved?

Review current literature on all available barrier products, techniques and applications in all types of protection situations.

Document successful existing dam application prototypes (re: Bill Hawkins note re: a Montana dam use of Bio-barrier)

Determine dam feasibility, assess application potential, recommend any further testing (field/laboratory)

Develop a state-of-art report on current technology, constraints (cost, environmental, etc.), matrix of products/applications.

4. Project Lead and Contact

A. Who is working in this area?
B. Who might be able to lead the project?
C. Who are good candidates to complete the work?

Seek matching funds from Bio-barrier (Nashville) and other similar industry reps.

B. Tschantz, Univ of Tennessee, P.I., perhaps in cooperation with people from NRCS and US FS.

Also with Tom Renckly with Maricopa County FCD

Results

Item 3. Topics Developed for Future Research and Development Projects

1. Title/Description of Research Item:

Effects Trees and Other Woody Vegetation Have on Earthen Dams, or "Trees Are No Friends to Dams"

2. Description

A. Why is this a priority research item?
B. What is the expected outcome?

To educate dam owners, engineers and government officials on the damaging effects tree roots and woody vegetation have on dams, especially earthen dams.

3. Project Tasks and Needs

A. What tasks are to be done?
B. How is the problem to be solved?

Specialized study on actual dams showing what effects tree roots have, how far into the dam do they penetrate, what effects the phreatic line has on roots. Do the study on an actual dam. Find some dam owners with these problems and get them to let a study be made on the inside of the dam.

4. Project Lead and Contact

A. Who is working in this area?
B. Who might be able to lead the project?
C. Who are good candidates to complete the work?

Dr. Bruce Tschantz, UT Knoxville

Dr. Dan Marks, S & ME

Also, a parallel on animals with Dave Woodward, NCSU, and Dr. Dan Marks, S & ME

1. Title/Description of Research Item:

Collaborate with Ongoing Animal Damage Issues, Research and Operations

2. Description

A. Why is this a priority research item?
B. What is the expected outcome?

Similarity of problems in other areas

Reducing redundancy in addressing questions

3. Project Tasks and Needs

A. What tasks are to be done?
B. How is the problem to be solved?

Identify who is working on these problems. Ensure researchers are aware of concerns/needs of dam specialists.

4. Project Lead and Contact

A. Who is working in this area?
B. Who might be able to lead the project?
C. Who are good candidates to complete the work?

National Wildlife Center, Dick Curnow, Director (970/266-6000)

Wildlife Services – Regional offices

Raleigh, NC – Eastern Region: Gary Larson

Denver, CO – Western Region: Mike Worthen

Results

Item 3. Topics Developed for Future Research and Development Projects

1. Title/Description of Research Item:

Handbook (weather-proof) for Dam Inspectors and Staff

2. Description

A. Why is this a priority research item?
B. What is the expected outcome?

Concise, basic technical information with illustrations which can be used to identify vegetative and animal problems or threats to dam safety and maintenance.

3. Project Tasks and Needs

A. What tasks are to be done?
B. How is the problem to be solved?

Involve engineering expertise, soils, vegetative, wildlife, and safety in developing current research knowledge and translating this into an extension type of handbook for use by dam inspectors and staff. Fact Sheet with more specific details can then be developed for use to address problems identified.

4. Project Lead and Contact

A. Who is working in this area?
B. Who might be able to lead the project?
C. Who are good candidates to complete the work?

ASDSO/Dam and wildlife services, state land grant university researchers.

We recommend that a state cooperative extension service specialist be contracted with to do this work.

Contact: James E. Miller, National Program Leader, Fish and Wildlife, USDA-CSREES/NRE, Rm 829 Aerospace Center, AG Box 2210, Washington, DC, 20250-2210

Results

Item 3. Topics Developed for Future Research and Development Projects

1. Title/Description of Research Item:

Guidelines/Awareness Document for Dam Owners

2. Description

A. Why is this a priority research item?
B. What is the expected outcome?

Concise, practical information written in non-technical language which would help landowners identify plant and animal threats or hazards and a list of state or federal agencies to contact for more information about specific problems.

3. Project Tasks and Needs

A. What tasks are to be done?
B. How is the problem to be solved?

Assembling known information and developing appropriate review to produce final document for dissemination and use by dam owners/community leaders and the public.

4. Project Lead and Contact

A. Who is working in this area?
B. Who might be able to lead the project?
C. Who are good candidates to complete the work?

ASDSO/Dam and wildlife services, state land grant university researchers, state cooperative extension services

Contact: James E. Miller, National Program Leader, Fish and Wildlife, USDA-CSREES/NRE, Rm 829 Aerospace Center, AG Box 2210, Washington, DC, 20250-2210