

A COMPARISON OF COMPUTER SIMULATION TECHNIQUES
IN DEPICTING AND COMMUNICATING THE VISUAL IMPACTS
OF TIMBER HARVESTING
IN THE JEFFERSON NATIONAL FOREST

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(ABSTRACT)

Advances in computer technology have made it possible for designers to manipulate realistic images on a computer screen. Previously, most computer generated images consisted of line drawings or distorted grid perspectives. A program known as PC/NewPerspectives, which generated distorted grid perspectives, has been in use by US Forest Service Landscape Architects who use it to determine the visual impact of a proposed harvest unit and manipulate the layout to reduce the impact. New programs in video imagery offer the opportunity to design harvest layouts on a more realistic format, which may also be used as a communication tool to relay to members of the public what the proposed alteration would look like. This study compares the two media in terms of landscape preference and acceptability of activity to determine the difference in the two media as communication tools and how this would influence their effectiveness.

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Introduction

Beginning with a brief sketch of the recent importance of environmental issues and their impacts upon the US Forest Service, this section then examines the need for improved communication between the US Forest Service land managers and the public. It is this need and how to facilitate this need which initiated this research. The research questions and methodology are then discussed. Following the discussion, the impacts of the research upon the US Forest Service and Landscape Architects are provided.

Environmentalism and the US Forest Service

Environmentalism, spotted owls, old growth forests, animal rights, Mt. Graham squirrel, and recycling, these words express the sentiments of the decade. Americans continue to grow increasingly interested in the welfare of their country and the planet. One area of concern has been the harvesting of trees. Ranging from the trees in their neighborhood to the trees in the rain forests of Brazil, Americans are fighting to keep trees from being harvested.

The US Forest Service has long been known for its ability to produce trees for wood products. For certain species, clearcutting is the most economical and silviculturally sound harvest method. In clearcutting, all merchantable trees are harvested from an area; the remaining trees are then felled or left for wildlife habitat. Clearcutting units have come in a variety of sizes, ranging from upwards of 200 acres down to 2 acres.

Some twenty years ago, Americans began to challenge the Forest Service on this practice of clearcutting trees. Two cases, one in West Virginia on the Monongahela National Forest (1975), and one in Montana on the Bitterroot National Forest, where citizens brought suit on the Forest Service for the aesthetic degradation caused by clearcutting, led to the National Forest Management Act. This legislation places restrictions on clearcutting, and

also, states that clearcutting is to be considered the "last option" for use as a timber harvesting method.

Today, the Forest Service continues to use this method. At times, this means that mitigation measures must be used to ensure that the impacts on the aesthetic quality of an area are minimized when using this technique. When such methods (clearcutting) may provide the potential for controversy, an Environmental Assessment (EA) must be written and made available for public comment, as stated in the National Environmental Policy Act. The District Ranger decides whether and how an area will be harvested after reviewing the EA for that particular site. The public then has 45 days to appeal the decision.

With the increased awareness of environmental issues, and increasing sensitivity about how public land in this country is being managed, the number of timber harvest appeals has risen. Many National Forests are mired down with appeals, to the point where no timber is being harvested or as in the case of the Forests within Spotted Owl habitat, the amount has been permanently or drastically reduced. (USFS).

With degradation of aesthetic attributes of the landscape being a primary objection to the clearcutting method, more needs to be done to ensure that not only does the layout of a timber harvesting unit meet visual quality standards that the agency has outlined for itself in the Visual Resource Management documentation¹, but also that the American public can visualize just what effect the clearcutting will have upon the aesthetic quality of an area.

¹The Visual Resource Management System of VRM was formulated by the US Forest Service Landscape Architects to create a unified approach to managing the visual resource that the National Forests provide.

Communication Need

Therefore, the Forest Service needs to be able to present proposed timber harvesting in a manner that is readily comprehensible to the American citizen. If the potential results of the agency' proposed actions could be better communicated to the public, then perhaps not only would the agency be able to respond better to public need, but also produce higher quality results where aesthetics are of concern. Communication of the potential results could be achieved using simulations.

A variety of simulation techniques exist at the present time, ranging from the abstract to the realistic, from the simple to the complex. Forest Service Landscape Architects working in mountainous terrain utilize a computer program known as PC/New Perspectives or Perspective Plot to create distorted grid drawings of the terrain, an abstract image. Another computer simulation technique that has just begun to be used is that of video imagery. Video imagery programs allow the designer to manipulate the scenery using "paints" or "pasted in" images. This computer simulation technique uses actual photographs or video images (those taken with a video camera) entered as digital information. Thus, the designer can then manipulate the picture by altering colors, entering portions of other pictures (such as that of a tree) in to the working picture, and inserting text. Hardware for video imagery programs also provides an array of hard copy types, ranging from color ink jet prints to photographic prints to videos.

Thesis Topic

This thesis compares these two methods, PC/New Perspectives and video imagery, as presentation graphics for use in communicating proposed timber harvesting visual impacts. Participants were shown slides of both types of drawings and asked to provide their preference for each scene and then to rate the acceptability of the harvest unit shown in the scene. Preference and acceptability were rated in two different sections of the questionnaire.

Participants rated scenes for preference that depicted the actual scene (photograph), video images of the same scene with and without the proposed harvest unit, and PC/New Perspectives drawings of the same scene with and without the outline of the proposed harvest unit. Only those scenes that depicted timber harvest unit layout were used for the acceptability segment of the questionnaire. Following the rating of scenes, the subjects also were asked about their attitudes toward and their understanding of the processes involved in timber harvesting on National Forest lands. The results of the responses to preference and acceptability were compared, with some of the group factors that were determined by the results of the last section on attitudes. Thus, it was not only important to verify which of these computer programs best depicts the impacts of timber harvesting, but also how acceptability of the harvesting may be related to attitudes.

Impacts of the Research

Because of the Spotted Owl controversy and the numerous appeals on proposed timber harvesting, the Forest Service is currently receiving much negative publicity. By using better methods of communication and by increasing their understanding of the American public's attitudes toward the harvesting of trees, the Forest Service may be able to not only better manage the visual resources on the land it administers, but also increase public trust in them again. Landscape Architects will have to play an increasing role in bringing the technology to the Forests, and in presenting the technology to the public groups so that they understand the intentions of the agency regarding visual resource management. Key to this will be what the "limits of acceptable change²" are. Preference studies that look at clearcutting and/or other harvesting methods will need to be increased and reviewed by the Forest Service Landscape Architects.

²Limits of Acceptable Change is a term derived from the Recreation Opportunity Spectrum. It refers to the degree of impacts a site can withstand before it will no longer be considered an attractive site to the recreationist.

The Forest Service and the Landscape Architects who work for the agency must keep up with technological changes in simulation techniques that will help them communicate better with the American public, and must also keep up with the public's attitudes toward their environment. In this way, the agency can reflect the needs of the public with sound management of public lands.

This document discusses some of the literature relative to the simulation techniques and the methods in which ratings have been applied, prior to specifically showing how this research project was designed. The statistical results along with their interpretations are then presented, followed by some discussion as to the implications of this research project for the Forest Service and the Landscape Architects that work for the agency.

Conclusion

Being a government agency, the US Forest Service easily can become bogged down in bureaucracy. The agency also is slow to change. Though it has improved its response to the NEPA legislative requirements, actual land management practices have not yet changed much to the public's environmental concerns. Fears of aesthetic degradation lead to appeals on timber harvesting. Simulation techniques may offer a method of alleviating the fears by showing what a proposed harvest unit might look like. The different methods used, provide different responses, and the lack of knowledge and awareness, but also indicate the degree of interest that the public has in public land management.

Literature Review

To understand the nature of this study, one must first become familiar with the Visual Resource Management system used by the US Forest Service, the simulation methods, preference testing on forest management practices, and the public involvement process instigated by NEPA. Some of the questions this research asks are:

What are simulations and what do they have to do with public participation? How effective are the methods at communicating the visual implications of the proposed alteration? (Zube, Simcox, Law, 1987). This section not only answers these questions but also provides an insight into why the research in this thesis is of importance to the professions of landscape architecture and environmental planning, and of interest to the Federal, State, and local governments or organizations that work with proposed land use alterations.

Forest Service Practices

Currently, the Forest Service uses PC/New Perspectives or Perspective Plot in designing the shapes of clearcuts so that the units will have the least amount of visual impact possible. And as a design tool it appears to work well. Recently, though, the public has begun to take a greater interest in timber harvesting. Whether this is a result of greater awareness of global deforestation and its environmental implications is not a subject of this research. Whatever the reason for the public's increased awareness of timber harvesting activity, it has become more in the interest of the Forest Service to present some of their clearcut design ideas to the public. It certainly is of legal interest since the Forest Service has lost law suits involving timber harvesting (Miller, 1988).

Since the Forest Service uses the PC/New Perspectives program in laying out timber harvesting in those areas with steep terrain, it has been these same drawings that have sometimes been used to present designs to the public. In presenting these drawings to the public, it is important that they are able to understand the alterations being depicted. This research aims to discover whether or not PC/New Perspective drawings are the best method to communicate to the public the visual implications of a proposed clearcut once completed. Not only would this be beneficial for the public in terms of developing better communications tools, but it would also protect the Forest Service to some extent from law suits from a surprised public who may feel very differently about a completed project if they believe they were misled, even unwittingly, in a public hearing on the design of a given timber harvesting project.

Simulations: Definition, Tool, Evaluated

Many people now own a personal computer and are able to do computer-aided-design, distorted squares three-dimensional drawings, and video imaging.

Three-dimensional models, too, are a popular form of simulation. These can be either simple, i.e., wads of paper placed about on a board, representing various objects in the landscape; or they can be rather elaborate and scaled (Miller, 1983).

Of course, one cannot forget the computer's contribution to simulations. At present, there are many programs that deal with design. Two kinds of programs that are of particular interest for this paper are those that produce distorted squares and video capture devices. The former is used in the program PC/New Perspectives and its predecessor, Perspective Plot, both of which the Forest Service uses in designing clearcuts.

Video imaging is a relatively new procedure that allows the computer operator to alter an

image of photographic quality right on the screen. In very basic terms, it is similar to the photo montage in that blocks can be inserted into other images to produce an image that is supposed to look like what the completed project would look like. In other words, it is thought to be a realistic representation (Baker & Rabin; Vining & Orland, 1988; Bishop & Leahy, 1989).

Future technologies promise to be even more revolutionary. Stewart Brand's Media Lab gives us some insight into these future trends (1988). Some of these include holographic images of objects, such as new car designs. In this way a designer or customer could examine the designed object even before it is built! Simulations also function as both design and communication tools. And, the creation of simulations is a regularly taught practice in design studios.

As a design tool, a simulation must be feasible enough to use on the given project. Various factors may affect the use of certain media in a professional setting. Speed of preparation is one of these factors. "Time is money" they say, and this is true in the design professions as well. If a simulation takes a very long time to produce, this will affect both the willingness of the designer to change his/her design and the economic feasibility to do so. Other factors involve such things as equipment. The type of equipment (i.e., computer hardware and software) required to produce the simulation may be very expensive. Also, equipment (i.e., slide projectors, overhead projector, video cassette recorder) may be necessary to present the simulation. Another important factor is the ability to view the design from various angles (Molnar, 1986). Models and some computer programs can provide this feature. The level of abstraction can also affect the design simulation. The designer may only want a rough idea of his/her design, such as a conceptual drawing. On the other hand, they may want to get an idea of what the finished project would look like before it is built. Here we see the differentiation between the conceptual and preconceptual

simulations (McKechnie, 1977; Zube, Simcox, Law, 1987). Attributes of the media may also influence the choice of which simulation technique to use (i.e., color versus black and white film).

Simulations are often used in presentations to clients or the public. Many factors that may affect the client/public's response to the media are: the level of abstraction, which may only confuse them; their attitude(s) toward the media, for example they may be more apt to watch a television screen than leaf through sketches; their attitude toward the land use alternative, which they may either see as positive or negative; their attitude toward the agency that has produced the simulation or land use alteration; their attitude toward the environment or landscape; familiarity with the landscape or the project; and what they come to understand about the project as a result of the simulation. Some developers try to promote their building by having simulations (renderings) which either lack accuracy or focus on the best view of the building whether or not it is a viewpoint that exists in the landscape (Shepperd, 1989). Obviously, some factors that affect design also affect the ability of the client/public to understand how the project will appear in the landscape. According to Zube, Simcox and Law's review of simulation literature, they state clearly that "realism in simulation is only one part, albeit an important part, of presenting design, planning, and management alternatives to the public," which leads back to the question of the effectiveness of abstract media as a communication tool (Zube, Simcox, and Law, 1987).

Previous research on simulation techniques has focused on either the evaluation of an individual medium, such as photography, or the comparison of two or more media with site-visits or slides of the actual completed project (Amedeo, Pitt, & Zube, 1989). Respondents have often been "experts," and/or professionals, from the fields of landscape architecture, architecture, or environmental planning. Several of the studies have been done in association with environmental psychology and the area of study dealing with cognition. Another important feature of these studies is that they are relatively recent, most having been

done in the late seventies to the present. However, there has not been a great deal of research on simulation techniques.

What suddenly thrust these techniques into the research arena? Undoubtedly, it had something to do with the legislative requirements and the availability of cheap computer technology. Public lands agencies, especially the Forest Service and the Bureau of Land Management, began developing their own methods of visual mitigation. Their task was to map the visual sensitivity of the lands they manage. Future land use modifications were therefore subject to the new visual management restrictions.

These two public agencies also set about creating guidelines for visual landscapes. Some of these involved how to determine what landscapes were visually sensitive. Others discussed methods of simulating land use alterations in the landscape so that visual impact could be assessed. It was these documents that brought the spotlight to simulations. There was an assumed inherent reliability placed upon simulation techniques as a result. Not too surprisingly, researchers began to question such a strong and yet tested assumption (Wood, 1988; Kaplan, 1988; Steinitz, 1988; USDA, 1974; USDI, 1976; Laughlin, Garcia, 1986).

Perceptual Surveys

It is in the arena of preference testing where management practices and people's reaction to the aesthetics of those management practices meet. Testing people on their attitudes toward landscapes has been a difficult task. The aesthetics of a place or scene may depend on people's frame of mind, the number of people they are with, and other ephemeral qualities of the landscape (Chenoweth & Gobster, 1990).

Establishing the "general" public has been one challenge. While cross-cultural differences may not be pronounced (Palmer) differences between sub-groups may be notable (Buhyoff,

et al. 1978; Leveson, 1988). Also, people's attitudes may change with the degree of familiarity with a given landscape (Kaplan, 1984). Most of the subjects of the studies have been predominately students, and they have been found to be representative of public perceptions.

The Scenic Beauty Estimation Method has been the most widely used evaluative technique in determining what members of the public feel has the attributes or for that matter what attributes of a "scenic" landscape (Daniel and Boster, 1976; Hull, 1989). It, in turn, also determines those that are not viewed as scenic, including those that may be disliked.

As mentioned earlier, preference testing typically examines management practices. Forest landscapes have been the object of research more than any other type of landscape. Numerous studies have been conducted looking at how people's preferences change when they see managed forests, unmanaged forests, dead trees, bare soil, forested mountains, various vegetative densities or types, big trees, openings, thinnings, stream courses, and so on (Ribe, 1989; Ribe, 1990; Hull, 1988; Zube, Pitt, and Anderson, 1974). Still others have examined how simulation technique may affect preferences (Tips & Savasdisara, 1986; Killeen, 1979).

Public Involvement

In 1969, the United States congress adopted the National Environmental Policy Act. Section 102 is the most important section for the federal agencies. It is here that aesthetics become intertwined with the law (Cats-Baril, Gibson, 1986).

This section calls for an interdisciplinary approach, identification of development methods and procedures, detailed statements concerning the environmental impact, study and development of appropriate alternatives, recognized global effects, information made

available to other public agencies and to the public, and the assessment of the Council on Environmental Quality.

The results of these authorizations and directions have led to a broadening of objectives, a more rational comprehensive approach, and opening of the planning process to the public, an alteration to the power structure by allowing the environmentalists to have more influence, a calling to layout the details of the process, and the environmental impact statement.

One of the steps in any Environmental Impact Statement is that of prediction. The purpose of prediction is to foresee what will happen if a particular action is taken. In the 1973 Council on Environmental Quality's guidelines, the EIS was not integrated into the planning process. The role of the public reflected the postponed integration of the EIS as they were not consulted on their environmental concerns until the draft EIS was submitted to them for their comments. Fortunately, this problem was remedied with new guidelines in 1978. As a result, the earlier involvement of people in determining the issues and concerns alleviated some of the problems of delays caused by the previous lack of involvement.

Prediction, though, requires the choice of attributes or variable of the environment such as water quality or wildlife habitat. After this, indicators or parameters that can be measured and described to indicate changes in the attributes are chosen. Some examples of these may be aquatic species or population numbers.

Methods are then applied to these indicators to determine their impact. One method is that of expert judgement. This is known as the Delphi technique. It consists of a survey given to experts who estimate the impacts of each alternative. The results of the survey are then tabulated to gain a consensus. Another method is that of comparative analysis that involves

comparing the proposed alternatives with similar projects and their impacts to gain an insight into what some of the impacts of the proposed project might be. Yet another method is that of modeling. Models are usually computer based and can be somewhat complex.

Because the future can never be foreseen, prediction is inherently uncertain, especially when it comes to indirect impacts. Despite these problems, it is still an integral part of the planning process.

Since simulations are a prediction tool, they are therefore subject to the same limitations found in the production of the EIS. Most EIS do not delve into the visual impacts of a land use alteration.

Attitudes toward Forest management

Popular media from newspapers, radio, and magazines reflect a growing concern that forests are not a readily renewable resource. The growth in the number of appeals of federal timber sales as exemplified by the spotted owl is one indication of how attitudes are changing. The Forest Service has begun to emphasize more "front-end" public involvement to resolve issues related to timber harvesting prior to the appeal process (USFS). A task force on visual simulations has been created to examine the use of visual simulations as a planning tool, not only at project level, but also at the Forest Plan level. With the change in attitudes the Forest Service has begun to take steps to further understand this change and how it can do things differently to meet the needs and desires of the American people.

Conclusion

The need to tie the preferences and the attitudes of the public with the designer's need to communicate the impact of proposed forest management activities has not received the

attention it so justly requires. From the research/literature reviewed, it becomes obvious that this is so. This thesis attempts to bring these topics together and to answer some landscape managers' and designers' needs to communicate more effectively with the public.

A great deal and a very little is known about simulations, especially in relation to their interpretations by the public. In the following chapter, methodology will be discussed; one will begin to see how timber harvesting, simulations, and the public all come together.

Methodology

In this section, the research questions shall be presented. In addition, the approach used to answer these questions shall also be discussed. This includes a description of the questionnaire, the scenes, and the computer generated drawings and images. Methods for analyzing the resulting data are also discussed.

Research Questions:

Visual Resource management has been used primarily as a mitigation tool in the Forest Service. For visually sensitive areas, landscape architects utilize the PC/New Perspectives program to analyze the layout of a timber harvest to see if it meets the visual quality objectives for that area. With this program they can then manipulate the layout to ensure that the visual impacts are within these objectives. This program was developed for and is used as a design tool. Its use as a communication tool has not been tested in the research arena, although the Forest Service has used it as such after explaining how to interpret the drawings to those viewing them (Wagner, 1988).

How well a proposed harvesting unit can be represented is not the only issue here. People's attitudes toward the manipulation of the landscape by activities such as timber harvesting, may be reflected in the ability of a media to effectively communicate an alteration. In other words, the reliability of the media as a realistic interpretation may be shown in how strongly people react to the acceptability of the alteration. For example, if a medium represents timber harvesting in a lifelike manner but overemphasizes the alteration through the use of contrasting, albeit natural, colors, the alteration may be rated as unacceptable; whereas if the colors used, blend with the natural landscape, the alteration may be rated acceptable. There is also the chance that the more realistic an image may appear to be, the more, or less, dramatic the alteration may appear. Through

the comparison of an abstract form of simulation, PC/New Perspectives, and a relatively realistic simulation, video imaging, these sort of impacts on acceptability might be realized.

The main purpose of this study was to investigate response of people to alternative methods simulating forest harvesting proposals. More specifically, the questions addressed in this research were:

- Does a simulation technique affect people's preference/acceptability ratings of a depicted scene?
 - Establish the reliability of ratings for different simulation methods.
 - Identify differences in the magnitude of the ratings for different methods. Between which type of simulations are these differences most apparent?
 - Determine whether ratings are affected by the presence or absence of the outline of the proposed timber harvesting activity.
 - Determine whether ratings for different simulation methods are differently affected by different landscape scenes (interaction effect between treatment and location).
- Do people respond differently to a portrayal depending on whether they are rating it for preference or rating it for acceptability?
 - Determine any differences in reliability between ratings.
 - Identify any differences in magnitude between preference

- and acceptability ratings.
- Identify differences between preference and acceptability ratings due to the sub-group (group interaction), type of simulation (treatment interaction) and/or particular scene (location interaction, treatment x location interaction).
- Do background factors influence responses to the landscape scenes or simulations?
- Establish the reliability of ratings for the student groups and the community service club.
 - Identify significant differences in the magnitude of the ratings for different groups.
 - Determine whether there are group differences in ratings due to the type of simulation and/or particular scene.

Prior to the development of the questionnaire, sites were selected, photographed, and manipulated on the computer. The following sections document the development of the research project from site selection to research design.

Visual Stimuli:

Quadrangle maps from U.S. Geological Survey were used to digitize the contours for the PC/New Perspectives program. Two different size "lenses" were used to create the New Perspective view models. These were 28mm and 50mm.

Photographs were taken from actual viewpoints. Lense size and azimuth³ were recorded to correspond with the actual view. The video capture camera had only a 50mm lens so only

³Azimuth is the distance, in degrees, from North.

50mm images could be captured. To avoid differences due to lens size rather than simulation type, only those PC/NewPerspective Plot drawings that used a 50mm lens setting were used to compare with the video images in the study (See appendix for prints of slides used in the study).

Once the video images were loaded onto the computer off the camera disk, the video images were then manipulated and stored using a combination of the Lumina and Rio programs⁴. The images were stored without any of the harvesting alterations. The PC/NewPerspective drawings (with the harvest unit layouts) were also captured on video, using the video capture camera, and stored. To place the outline of the harvesting unit on a video image of the landscape, the corresponding PC/NewPerspective drawing (now a video image itself) was scaled to meet the image, cut so that only the outline of the harvest unit remained and then pasted on the image. A soil color was selected from the video image and painted onto the soil area of the PC/NewPerspective harvest unit to give it a more realistic color.

Site Selection:

The Jefferson National Forest, located in southwestern Virginia, utilizes the PC/New Perspectives program, or its predecessor Perspective Plot, as a design tool. Due to the mountainous terrain⁵, the program is used to determine the extent to which alterations will be visible to travelers, recreationists, and local residents; and if so, what the visual impact of those units may be.

For this project, two timber sale areas were selected on the Blacksburg District of the Forest.

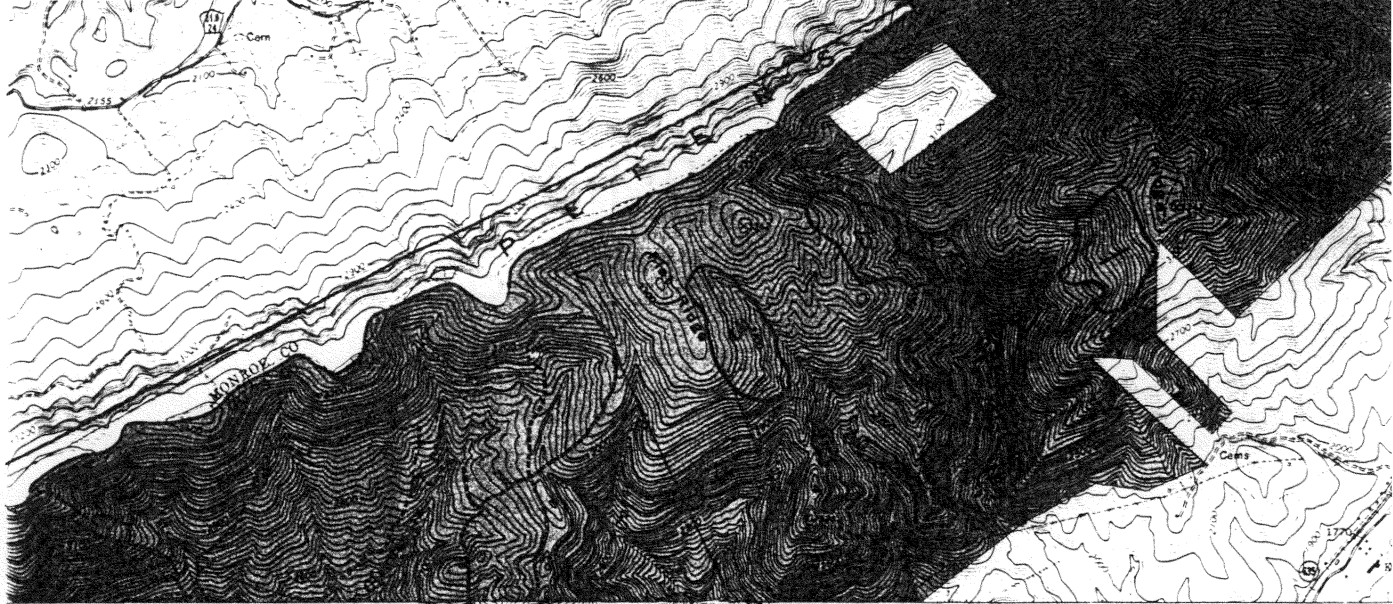
⁴Lumina video imaging program allows the designer to manipulate the image by "cutting and pasting" primarily. Rio, on the other hand, gives the designer the opportunity to "paint" on the images using either colors already present in the image or from a palette. With Rio, text can also be created and inserted onto the images in a variety of font styles, sizes, and colors.

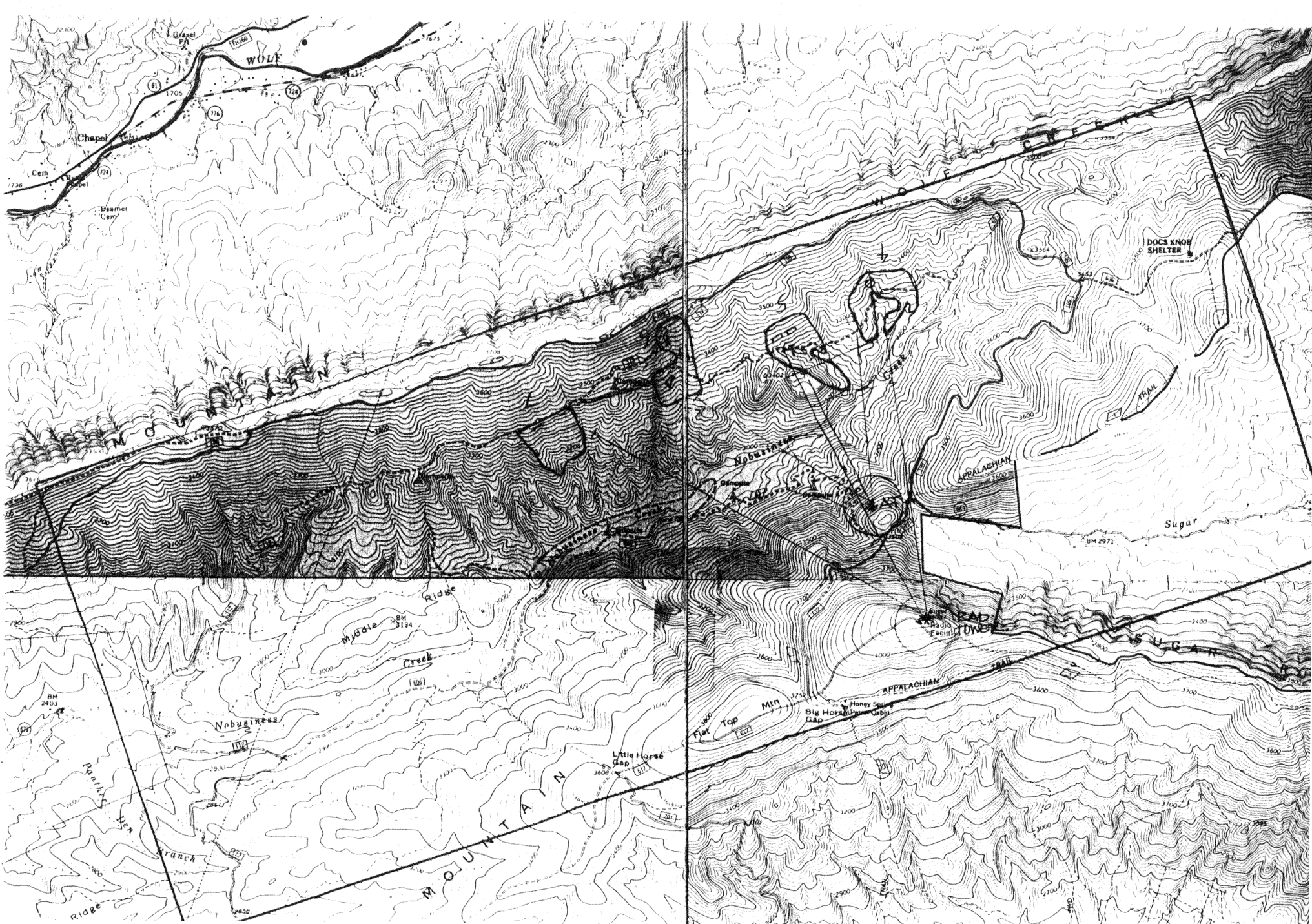
⁵Two mountain ranges exist in the area, the Appalachians and the Blue Ridge.

These sites were selected based on the need for representations of these alterations by the Forest Landscape Architect because the alterations had the potential of being seen from travel corridors and due to a short deadline to produce simulations. The Forest Landscape Architect requested the viewpoint locations as those that he felt would provide the greatest visibility of the projects. One sale area was located on a mountain to the north of Pearisburg, Virginia between Mystery Ridge and Flat Ridge. This sale area consisted of three proposed alterations. They were potentially visible from State Highway 460 and County Road 100. The proposed timber harvest alterations ranged in acreage from 40 acres to 47 acres in size. The other sale area was located farther west and south, closer to the town of Narrows. These proposed alterations lie along the southeast face of Wolf Creek Mountain. Although these alterations could not be seen by the everyday traveler as those in the other sale area, the Appalachian Trail traverses along the other side of the valley, creating the possibility of these alterations being visible from the trail. There also is a radio tower on the knob that the Appalachian Trail wraps around. The radio tower site is used for camping by hikers, and also allows for a clear and open view of Wolf Creek Mountain. There are four timber harvest alterations on this mountain. The size of these alterations ranged in acreage from 34 to 44 acres (See maps pages 20 and 21).

Viewpoints:

For each of the timber harvest units, viewing points were identified. The locations of the viewpoints were determined by identifying locations that would have the highest visual impact along the travel corridors. The Mystery Ridge sale area had five viewpoint locations. The first of these points is at the intersection of State Highway 460 and County Road 635. This location is termed "635" in the remainder of the document. Its distance from the proposed units averaged 4.3 miles. To the west of 635 another view point was selected. This view was from a bridge that crosses the New River, and is called "Bridge." The





average distance from the units to this view point was 4 miles. The exchange for the town of Ripplemead is the site of the next view point. "Ripple" is the reference name for this view point, and its distance from the alterations averaged 3.8 miles. Two viewpoints were selected along County Road 100. One is termed VA100, the other VA100-Curve. Their average distances were 5.5 and 5.1 miles, respectively. The azimuths of the viewpoints were used in developing the PC/New Perspectives drawings and the photography for the video imaging (See Table 1).

There were fewer Wolf Creek Mountain viewpoints. One is from the Appalachian Trail; the other, from the Radio Tower. In this case, though, three different azimuths were selected for each viewpoint to get a more panoramic picture of the proposed alterations. Again, this information was utilized in the computer drawings and images. The proximity of these alterations to the viewpoints was much closer than for the previous area with the viewing distance ranging between 0.7 to 1.78 miles (See Table 1).

TABLE 1. UNIT ACRES AND DISTANCES FROM VIEWPOINTS

TIMBER HARVEST UNIT	SIZE IN ACRES	DISTANCES between VIEWPOINTS & UNITS (miles)					
		VA100 Curve (V1)	Radar 300 (V2)	Radar 334 (V3)	Radar 350 (V4)	Int 635 (V5)	Ripple (V6)
1	47	4.71	N/A	N/A	N/A	4.28	3.81
2	40	5.13	N/A	N/A	N/A	4.57	3.85
3	41	5.23	N/A	N/A	N/A	4.14	3.57
4	38	N/A	1.78	N/P	N/P	N/A	N/A
5	34	N/A	1.42	1.42	N/P	N/A	N/A
6	44	N/A	N/P	1.32	1.14	N/A	N/A
7	41	N/A	N/P	1.28	1.35	N/A	N/A

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acceptable, 2 = slightly acceptable, 3 = somewhat acceptable, 4 = moderately acceptable, and 5 = very acceptable. The respondents were asked to assume that these scenes depicted views from a major highway and that the units were located on National Forest land (This was to provide the group with the same frame of reference). Twenty-four slides were shown in Part B. Half of these slides were shown previously in the preference section. The others showed Perspective Plot drawings and their corresponding actual harvest photographs.

Part C consisted of questions on the background of the respondents including the extent to which the respondents use National Forest lands, their knowledge of National Forest management, their attitudes about timber harvesting, their attitudes toward the importance of public involvement in forest planning and various demographic characteristics including age, education, place of residence, occupation and membership in environmental groups. The object of this section of the questionnaire was to determine whether or not attitudes or background might have an influence upon how the respondents rated the scenes for preference and acceptability.

The Respondents:

The slides were shown to and the questionnaire administered to three groups. The total number of respondents was 52. The first of these groups was a community service club that has a membership that consists primarily of white males. (N=14). The other two groups were undergraduate English students at Virginia Polytechnic Institute and State University. (N=38). Because the majority of the respondents were students (70.8%), the bulk of the respondents (66.7%) was between the ages of 18 and 25. This is also reflected in the time that the participants have lived in the region with 45.1% having lived there less than 5 years. With the community club being composed of solely males, the proportion of male respondents in the total of the groups was 70.6%. Only 5.8% of the respondents had no college or postgraduate degrees. Few (15.7) of the respondents are members of

environmental clubs. Of those that did belong, a couple were members of hunting clubs as opposed to clubs such as the Sierra Club. Although the number of respondents met the minimum (50), a larger sample would have been desirable.

To get a perspective on how attitudes and background may influence the responses given by the participants, grouping factors were identified (See Table 2). These ranged from the participants' familiarity with timber harvesting, attitude about timber harvesting, years lived in the area, and their gender.

TABLE 2. GROUPING FACTORS EXAMINED IN THE STUDY

GROUPING FACTOR	GROUPS
Group Type	Community Club - Students
Background History	Never Seen - Previously Seen Timber Harvesting
Timber Harvesting Attitude	Harvesting is compatible - incompatible with your favorite things about this landscape
Gender	Male - Female
Years Lived in Area	Less than 5 - More than 5

Ratings Sessions:

The presentations took place during class time for the students and at a meeting of the local club. The 35mm slides were projected to a size of approximately 20' x 16'. Prior to the slide presentation, the project was explained (each group was told the purpose of the study, the number of sections, a brief description of the section, and that their responses would be anonymous) and examples of the slides (2 for each section), which were not part of the slides that were rated, were shown to allow the respondents to learn how to use the rating system.

The service club and one group of students were shown the slides in one order; the other group of students was shown the same slides but in reverse order to reduce the possibility of the "order effect."⁶ Following the slide presentation the participants were asked to fill out the remainder of the questionnaire. The entire presentation and response to the questionnaire took approximately twenty minutes to complete.

Statistical Analysis:

A repeated measures analysis of variance design (Winer, 1971) was used to structure the problem for statistical analysis⁷. The major analyses were conducted, one for the preference ratings, one for the acceptability ratings, and one incorporating both preference and acceptability ratings into the analysis.

The preference analysis included two trial factors, "viewpoint" with 6 repetitions, and "simulation method"⁸ with 5 repetitions. (See Table 3.)

⁶Order effect is the test subjects reaction and response to the slides cause by the order of viewing.

⁷With the research focusing on a comparison between simulation types and their ratings, this form of statistical analysis is the most appropriate one. Specifically, the program used was SYSTAT.

⁸Describes not only the media type, but also whether timber harvesting was represented.

TABLE 3. RESEARCH DESIGN FOR THE PREFERENCE RATINGS

SIMULATION METHOD	VIEWPOINT					
	VA100 CURVE (V1)	RADAR 300 (V2)	RADAR 334 (V3)	RADAR 350 (V4)	INT 635 (V5)	RIPPLE (V6)
ORIG. SLIDE (S1)	V1S1	V2S1	V3S1	V4S1	V5S1	V6S1
VIDEO UNCUT (S2)	V1S2	V2S2	V3S2	V4S2	V5S2	V6S3
VIDEO CUT (S3)	V1S3	V2S3	V3S3	V4S3	V5S3	V6S3
P PLOT UNCUT (S4)	V1S4	V2S4	V3S4	V4S4	V5S4	V6S4
P PLOT CUT (S5)	V1S5	V2S5	V3S5	V4S5	V5S5	V6S5

Several ways of grouping the respondents were also examined as part of the analysis to see whether subgroups of respondents rated the scenes differently. Grouping factors were chosen based on prior hypotheses about potential differences between groups and whether there was a sufficient number of respondents within the subgroups to conduct an adequate test. Further analysis of the grouping factors is found in the results section. Grouping factors were tested one at a time, and included variables shown in Table 2 .

In Table 3 the cells V1S1, V2S1 . . . V6S5 each represent a landscape scene with a particular combination of viewpoint (V) and simulation method (S) for which preference ratings were obtained. Analysis of preference ratings for these 30 cells was based on the mean scores from the 52 study participants; these ratings were also split by group factor to examine differences in sub-groups on preference ratings.

The research design for the acceptability ratings was similar to the one for the preference ratings, with one exception. Since the acceptability ratings focused only on scenes showing timber harvesting, only a subset of 2 treatment repetitions from the preference ratings could be used, as diagramed in Table 4:

TABLE 4. RESEARCH DESIGN FOR THE ACCEPTABILITY RATINGS

SIMULATION METHOD	VIEWPOINT					
	VA100 CURVE (V1)	RADAR 300 (V2)	RADAR 334 (V3)	RADAR 350 (V4)	INT 635 (V5)	RIPPLE (V6)
VIDEO CUT (S3)	V1S3	V2S3	V3S3	V4S3	V5S3	V6S3
PLOT CUT (S5)	V1S5	V2S5	V3S5	V4S5	V5S5	V6S5

Each of the 12 cells in the diagram represents acceptability ratings collected for the six landscape scenes (V1, V2 . . . V6) viewed under the two simulated timber harvest treatments, video (S3) and perspective plot (S5). As with the preference ratings, the same examination of the subgroups was included in the analysis to test differences between subgroup's perceptions about the acceptability of the landscape scenes.

To assess differences between preference and acceptability ratings a third analysis was conducted using "rating type" (with 2 repetitions) as a third trial factor⁹. Since the acceptability ratings focused only on scenes showing timber harvesting, only a subset of 2 treatment repetitions (only those corresponding portrayals that depicted timber harvesting using the same simulation methods) from the preference ratings could be used, as diagramed in Table 5:

⁹In this case, a third trial factor is used in the comparison between respondents ratings for simulation methods and viewpoints. This trial factor compares preference and acceptability ratings.

TABLE 5. RESEARCH DESIGN FOR PREFERENCE-ACCEPTABILITY COMPARISON

SIMULATION METHOD	VIEWPOINT					
	RATING TYPE (Preference= P, Acceptability= A)					
	VA100 CURVE (V1)	RADAR 300 (V2)	RADAR 334 (V3)	RADAR 350 (V4)	INT 635 (V5)	RIPPLE (V6)
VIDEOCUT (S3)	PV1S3	PV2S3	PV3S3	PV4S3	PV5S3	PV6S3
	AV1S3	AV2S3	AV3S3	AV4S3	AV5S3	AV6S3
PPLOT CUT (S5)	PV1S5	PV2S5	PV3S5	PV4S5	PV5S5	PV6S5
	AV1S5	AV2S5	AV3S5	AV4S5	AV5S5	AV6S5

As with the second research design, the cells in the diagram above represent the 6 landscape scenes under the two simulation methods (S3) and (S5). Each of the 12 scenes used in this analysis was rated twice by study participants, and preference (P) and acceptability (A) repetitions are shown in the diagram as the third trial factor.

Each of these three research designs allows one to test the "main effects" of the group and trial factors separately, test the "interaction" between factors, and test "contrasts" between specific treatment levels of factors and their interactions (e.g., to test whether the variation in ratings between video timber harvests and perspective timber harvest simulation methods is statistically significant).

CONCLUSION

In the preceding paragraphs, the methodology for the thesis research was explained. How sites were selected, what viewpoints were used, the development of the questionnaire and how the resulting data was analyzed was provided. The analysis is especially complex due

to the third trial factor introduced when comparing responses to the preference segment and the acceptability segment. The following section of the research examines the results of the data analysis.

Results

The basic question of this research asks how different computer simulation methods affect the way people rate the landscape depicted both in terms of how much they prefer that landscape and how acceptable they find a proposed landscape alteration. A second question of this research is to what extent do peoples' attitudes toward the US Forest Service and Forest Service policies influence their reaction to proposed timber harvesting. Lastly, this research asks the extent to which background characteristics of respondents such as age, education and occupation influence their reaction to proposed timber harvesting.

The following analysis begins with a discussion of the preference ratings results, then the acceptability ratings results, and then finally discusses the results of the questionnaire that looked at awareness of public management and attitudes toward timber harvesting (background characteristics are not discussed due to lack of statistical significance).

ANALYSIS OF PREFERENCE RATINGS

Reliability. The reliability of preference ratings was assessed using the intra-class correlation coefficient (Ebel, 1951). This measure indicates the expected mean correlation between ratings obtained from any two observer groups, drawn from the same population as the sample group (Brown, et al., 1990). Of the various measures of rating reliability, this formulation is most commonly reported in the scenic beauty literature (e.g., Brown and Daniel, 1987). The reliability of the preference ratings, over all observers and scenes, was 0.908.

Comparison of Simulation Methods. The repeated measures analysis of variance showed a highly significant main effect for simulation method. This means that at least one of the treatments was statistically significantly different from the other four. The analysis of variance table (Table 6) for this test includes both the univariate repeated measures F-test as well as three multivariate test statistics. In this case both types of test statistics are significant at $p \leq 0.000$. While the univariate statistic is the one traditionally reported, it relies on highly restrictive assumptions that are almost never met with real data. According to Wilkinson (1985) the multivariate statistics are more trustworthy because they do not require the "compound symmetry" assumption. In cases when the univariate and multivariate statistics would lead one to different conclusions, it is safer to rely on the multivariate interpretation.

TABLE 6. MEAN VALUES FOR THE PREFERENCE RATINGS

SIMULATION METHOD	VIEWPOINT					
	VA100 CURVE (V1)	RADAR 300 (V2)	RADAR 334 (V3)	RADAR 350 (V4)	INT 635 (V5)	RIPPLE (V6)
ORIG. SLIDE (S1)	3.698	3.163	3.419	3.628	3.093	3.302
VIDEO UNCUT (S2)	3.093	3.558	3.512	3.581	3.349	3.395
VIDEO CUT (S3)	2.558	2.791	2.419	2.209	2.767	3.163
PLOT UNCUT (S4)	2.953	2.326	2.744	2.488	3.070	3.140
PLOT CUT (S5)	3.628	3.907	3.605	3.558	3.256	3.651

Figure 1 is a plot of the mean preference ratings (shown in Table 6), by location, for each of the 5 simulation methods. It appears that for most locations, the unadulterated slides received the highest preference ratings, followed by the uncut and clearcut video simulations, with the uncut and cut perspective plot simulations receiving the lowest ratings. The patterns are somewhat difficult to discern by looking at all five treatments at once, and statistical analysis of treatment pairs helps to clarify the results of the analysis by enabling the researcher to ask specific questions about the data. This is done by developing hypothesis tests that set up a "contrast" matrix between two treatments, as described by Wilkinson (1985).

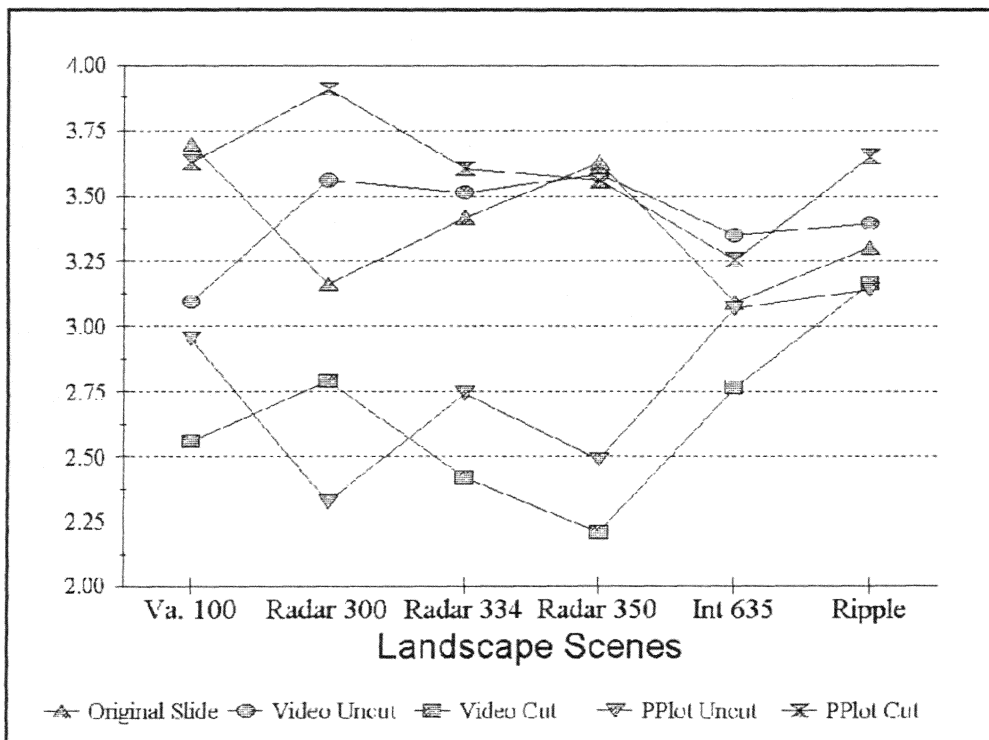


Figure 1. Mean Preference Ratings - All

The primary question about the difference between simulation methods is addressed by

contrasting slides, video images, and perspective plot pairs. To control possible effects of the timber harvesting treatment affecting this comparison, only the "uncut" simulations are tested for this analysis. The results of the hypothesis tests for these treatment pairs are shown in Table 7.

TABLE 7. TEST FOR MAIN EFFECT OF TRIALS FACTOR: "SIMULATIONS"

UNIVARIATE REPEATED MEASURE F-TEST					
Source	SS	DF	MS	F	P
Hypothesis	243.211	4	60.803	35.712	0
Error	279.255	164	1.703		

MULTIVARIATE TEST STATISTICS			
TEST	F-STATISTIC	DF	PROB
Wilk's Lambda = 0.290	23.313	4, 38	0
Pillai Trace = 0.710	23.313	4, 38	0
Hotelling-Lawley Trace = 2.454	23.313	4, 38	0

Preferences for the landscape scenes differed significantly depending on the type of simulation the respondents were shown. Figure 2 is a plot of the same mean preference scores shown in Figure 1, but without the 2 "clearcut" treatments. Here it is a little bit easier to see the differences between treatments. As seen in Figure 2 and in the test statistics in Table 8, the slide and video treatments are the most highly preferred and most similar to one another, while for most locations the perspective plot stands alone with substantially lower preference ratings. This rating result probably reflects not only the preference for landscape, but also a preference for the realism of the depicted scene.

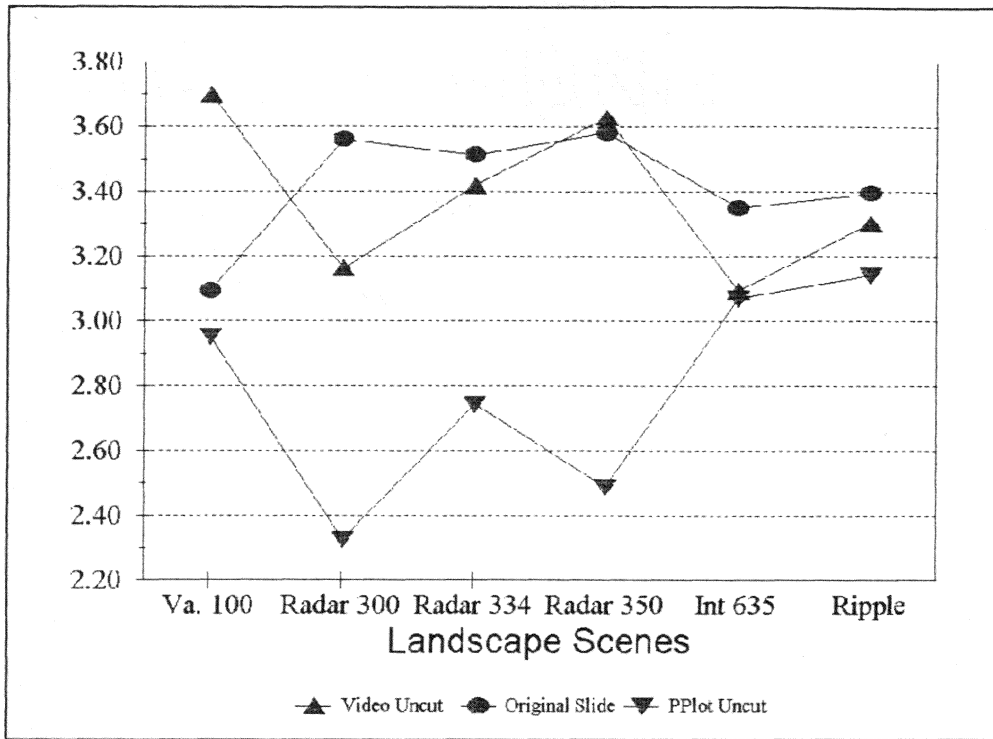


Figure 2. Mean Preference Ratings - uncut

TABLE 8. CONTRASTS BETWEEN INDIVIDUAL AND SIMULATION TYPES

CONTRAST BETWEEN SLIDE AND UNCUT VIDEO					
Source	SS	DF	MS	F	P
Hypothesis	112.575	1	112.575	8.211	0.007
Error	562.123	41	13.710		

CONTRAST BETWEEN SLIDE AND UNCUT P-PLOT					
Source	SS	DF	MS	F	P
Hypothesis	1880.707	1	1880.707	89.537	0.000
Error	861.200	41	21.005		

CONTRAST OF UNCUT VIDEO AND UNCUT P-PLOT					
Source	SS	DF	MS	F	P
Hypothesis	1073.021	1	1073.021	45.181	0.000
Error	973.723	41	23.749		

Analysis of Timber Harvesting Conditions. A secondary question in this research was whether the presence of timber harvesting had an effect on preference ratings for the scenes. This question was also investigated by examining particular contrasts between simulation pairs (cut/uncut). In this case it was necessary to control the simulation type and look only at cut versus uncut treatment pairs within each of the two simulation modes. These results are shown in Table 9 and plotted in Figures 3 and 4.

TABLE 9. CONTRASTS BETWEEN UNCUT/CLEARCUT SIMULATIONS

CONTRAST BETWEEN UNCUT AND CLEARCUT VIDEO					
Source	SS	DF	MS	F	P
Hypothesis	0.061	1	0.061	0.004	0.948
Error	576.544	41	14.062		

CONTRAST BETWEEN UNCUT AND CLEARCUT P-PLOT					
Source	SS	DF	MS	F	P
Hypothesis	23.293	1	23.293	3.844	0.057
Error	248.474	41	6.06		

As can be seen in the Table and Figures, the differences between the cut - uncut treatments are not nearly so great as they were between simulation methods. The analysis of variance test for the two video pairs is clearly not significant, and the test for the perspective plot pairs is borderline. While evidence in the research literature shows that clearcutting can have a significant negative impact on people's preferences for forest landscapes (e.g., Becker, 1983), within this particular research design the differences that did occur appeared to be overwhelmed by the differences between simulation techniques. To more thoroughly investigate the effect of clearcutting on perceived landscape preference, a different research design is needed that would use only a single simulation method.

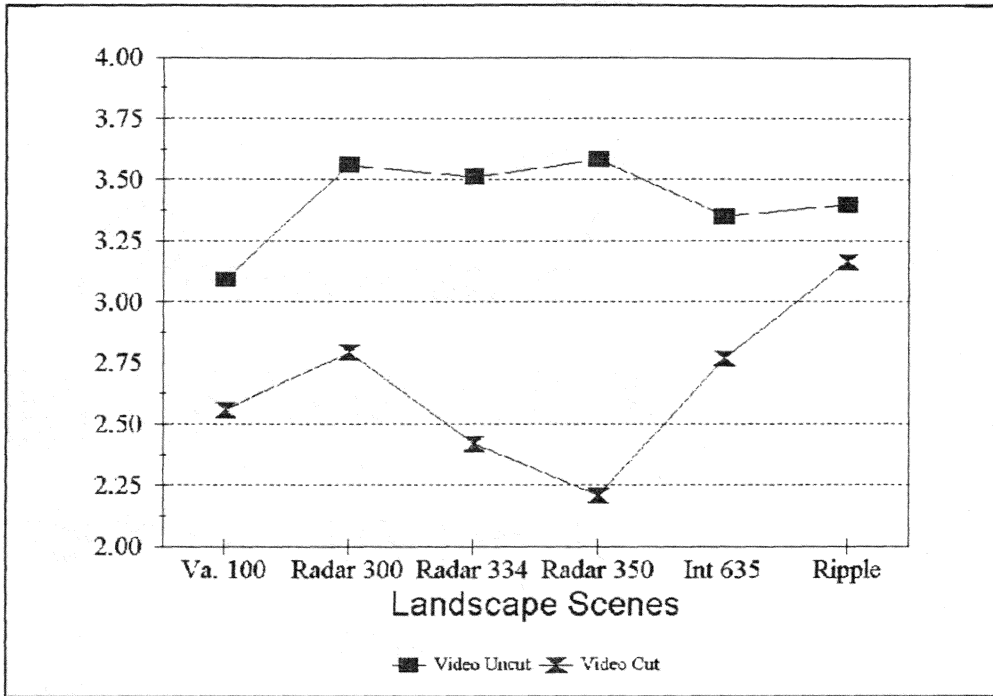


Figure 3. Mean Preference Ratings - Video

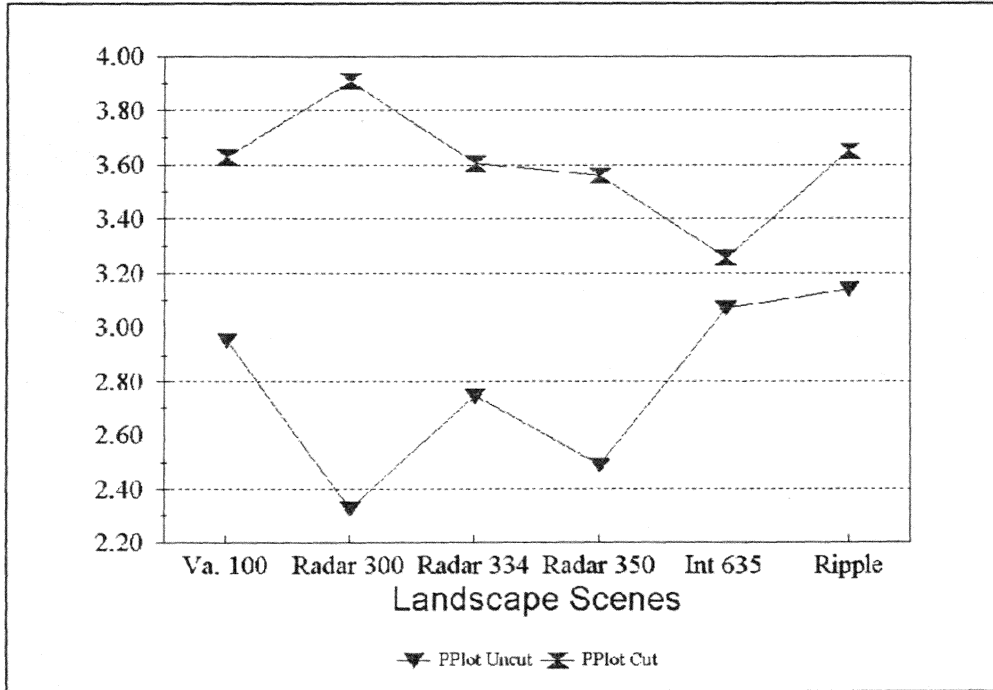


Figure 4. Mean Preference Ratings - PPlot

A final comparison of simulation methods involved rating reliability. It was thought that people's familiarity with slide and video media might result in more reliable ratings, but a test of comparative reliability estimates showed this was not the case. Using the group-to-group measure mentioned previously resulted in the following reliability estimates: regular color slide: 0.425; video image: 0.554; and perspective plot: 0.905. This unexpected difference in reliability indices may be somewhat confounded because the reliability measure depends in part on the sample size and the overall variation in ratings across scenes. It may be that the overall variation in ratings of perspective plot scenes was lower than the slide or video scenes, thus boosting the score. Further testing of these media with a wider number of scenes is necessary in order to get a better idea of comparative rating reliability.

The Effect of Location on Preferences for Treatment Methods. By themselves, the main effects of "simulation method" are interesting in that they provide the researcher with an idea about the significance of the *magnitude* of differences in ratings between simulation types. The data indicate that video and perspective plot simulations might be expected to receive lower preference ratings than color slides, at least for landscape scenes similar to the ones used in this study. However, examination of the plots in Figure 2 suggests that there may be more going on than just a difference in relative magnitude. If rating magnitude was the sole difference between simulation methods one would expect to find three parallel lines in Figure 2; instead the lines go up and down from location to location, and at times even cross one another. These patterns indicate that location may play a part in how scenes are rated, and may signal an *interaction* effect between simulation method and location. This possibility was tested by using "location" as a second trial factor in the repeated measures design.

TABLE 10. TESTS FOR EFFECTS OF TRIALS FACTOR: "LOCATION"

Test of Main Effect of Location:					
UNIVARIATE REPEATED MEASURE F-TEST					
Source	SS	DF	MS	F	P
Hypothesis	7.125	5	1.425	1.274	0.276
Error	229.258	205	1.118		
MULTIVARIATE TEST STATISTICS					
TEST	F-STATISTIC	DF	PROB		
Wilk's Lambda = 0.850	1.310	5, 37	0.281		
Pillai Trace = 0.150	1.310	5, 37	0.281		
Hotelling-Lawley Trace = 0.177	1.310	5, 37	0.281		
Test of Interaction Effect of Simulation x Location:					
UNIVARIATE REPEATED MEASURE F-TEST					
Source	SS	DF	MS	F	P
Hypothesis	38.753	20	1.938	3.127	0.000
Error	508.057	820	0.620		
MULTIVARIATE TEST STATISTICS					
TEST	F-STATISTIC	DF	PROB		
Wilk's Lambda = 0.283	2.790	20, 22	0.011		
Pillai Trace = 0.717	2.790	20, 22	0.011		
Hotelling-Lawley Trace = 2.536	2.790	20, 22	0.011		

Table 10 shows that for the 6 scenes used in the analysis, location by itself does not have a significant effect on participants' preference ratings. However, the interaction between location and simulation method is significant. This interaction effect indicates that simulation methods may be sensitive to the context in which they are used. To illustrate how this interaction might work, consider the following two hypothetical landscapes: a

mountain scene and a lake scene. Portrayed by video images, both of these scenes might receive relatively high preference ratings from a respondent group, while the perspective plots of the two scenes might both receive lower ratings. But the perspective plot of the mountainous scenes, due its topographic variety, has a high degree of complexity and would probably receive a proportionally higher rating than the perspective plot of the lake scene, which would be portrayed only by a flat, simple surface. It should also be noted that elements in the scene may also affect this. For example, buildings, wires, flowers, clouds, all of which would show up in a video image, would not be present in a pplot and thus influence the rating as well. This interaction between landscape type and simulation type can be detected by nonparallel lines when the preference ratings are plotted across scenes. In Figure 2 this interaction is apparent at several points along the graph. For example, the difference in mean preference ratings between the real photos and the video uncut remains relatively constant for 4 of the 6 six locations, with the ratings of the real photos about a half-point higher than the video photos. At VA100 Curve and Radar 350, however, the video ratings are actually higher than the real photos. These changes in magnitude are responsible for the statistically significant interaction effect identified in the ANOVA. The implication is that video images do a good job of causing similar responses as the real photos.

Group Differences in Preference Ratings. The final research question asked in this first data set was whether certain groups of respondents differed in their preferences for the landscape scenes. Information collected in the background questionnaire was used to partition the sample of 52 users into various subgroups for analysis, and a full two trial factor repeated measures ANOVA as described above was conducted separately for each of the grouping factors previously mentioned. Table 11 shows the main effects for each of these grouping factors:

TABLE 11. TESTS OF MAIN EFFECTS FOR GROUPING FACTORS

COMPAT (HARVESTING IS/ISN'T COMPATIBLE WITH LANDSCAPE)					
Source	SS	DF	MS	F	P
Hypothesis	8.800	1	8.800	1.328	0.258
Error	205.485	31	6.629		
SEX (MALE - FEMALE)					
Source	SS	DF	MS	F	P
Hypothesis	27.469	1	27.469	3.849	0.057
Error	285.497	40	7.137		
YRS LIVED (LESS THAN 5 - MORE THAN 5)					
Source	SS	DF	MS	F	P
Hypothesis	23.820	1	23.820	3.295	0.077
Error	289.146	40	7.229		
GROUP TYPE (CLUB vs. STUDENTS)					
Source	SS	DF	MS	F	P
Hypothesis	1.426	1	0.426	0.188	0.667
Error	311.673	41	7.602		
SEECUT (HAVE/HAVEN'T SEEN TIMBER HARVESTING PREVIOUSLY)					
Source	SS	DF	MS	F	P
Hypothesis	1.569	1	0.569	0.206	0.652
Error	311.530	41	7.598		

As seen in the table there were no strong significant differences in people's preference ratings due to their association with a particular group, although gender and years lived in the area was of borderline significance. Higher order interactions did occur between group type and simulation method and between years lived in the area and simulation method, but their meaningfulness is not clear conceptually. The test statistics are given in Table 12:

TABLE 12. TEST FOR GROUPING FACTORS INTERACTION

Group type and Simulation Interaction:					
UNIVARIATE REPEATED MEASURE F-TEST					
Source	SS	DF	MS	F	P
Hypothesis	68.405	4	17.101	10.044	0.000
Error	279.225	164	1.703		
MULTIVARIATE TEST STATISTICS					
TEST	F-STATISTIC	DF	PROB		
Wilk's Lambda = 0.617	5.903	4, 38	0.001		
Pillai Trace = 0.383	5.903	4, 38	0.001		
Hotelling-Lawley Trace = 0.621	5.903	4, 38	0.001		
Years Lived and Simulation Interaction:					
UNIVARIATE REPEATED MEASURE F-TEST					
Source	SS	DF	MS	F	P
Hypothesis	49.141	4	12.285	6.690	0.000
Error	293.802	160	1.836		
MULTIVARIATE TEST STATISTICS					
TEST	F-STATISTIC	DF	PROB		
Wilk's Lambda = 0.739	3.261	4, 37	0.022		
Pillai Trace = 0.261	3.261	4, 37	0.022		
Hotelling-Lawley Trace = 0.353	3.261	4, 37	0.022		

Finally, group-to-group rating reliability was tested for the various partitions of the subject group. Nearly all sub groups showed similar, moderate-to-high reliability scores, with females ranking the lowest and those living in the region longest ranking the highest. Reliabilities were: Group Type (Club 0.892, Students 0.863); Background (Never Seen Timber Harvesting 0.843. Seen Timber Harvesting 0.841), Attitude toward Harvesting (Incompatible 0.758, Compatible 0.854); Gender (Male 0.894, Female 0.681); Years lived

in Area (5 or less 0.696; more than 5, 0.893).

ANALYSIS OF ACCEPTABILITY RATINGS

Reliability. Group-to-group reliability was assessed for the acceptability ratings using the same measure as discussed previously. Reliability over all participants and scenes was 0.912.

Comparison of Simulation Treatments. The main effect of "simulation method" was examined to identify if there were any differences in the magnitude of ratings due to the type of simulation method.

TABLE 13. TEST FOR MAIN EFFECT: "SIMULATION TYPE"

UNIVARIATE REPEATED MEASURE F-TEST					
Source	SS	DF	MS	F	P
Hypothesis	1.636	1	0.636	1.410	0.242
Error	48.750	42	1.161		

Table 13 shows that the main effect was not significant, which indicates that participants did not assign significantly higher scores to the video simulations as compared to the perspective plots. This lack of difference is illustrated by the relatively close lines of mean acceptability ratings plotted in Figure 5 and shown in Table 14.

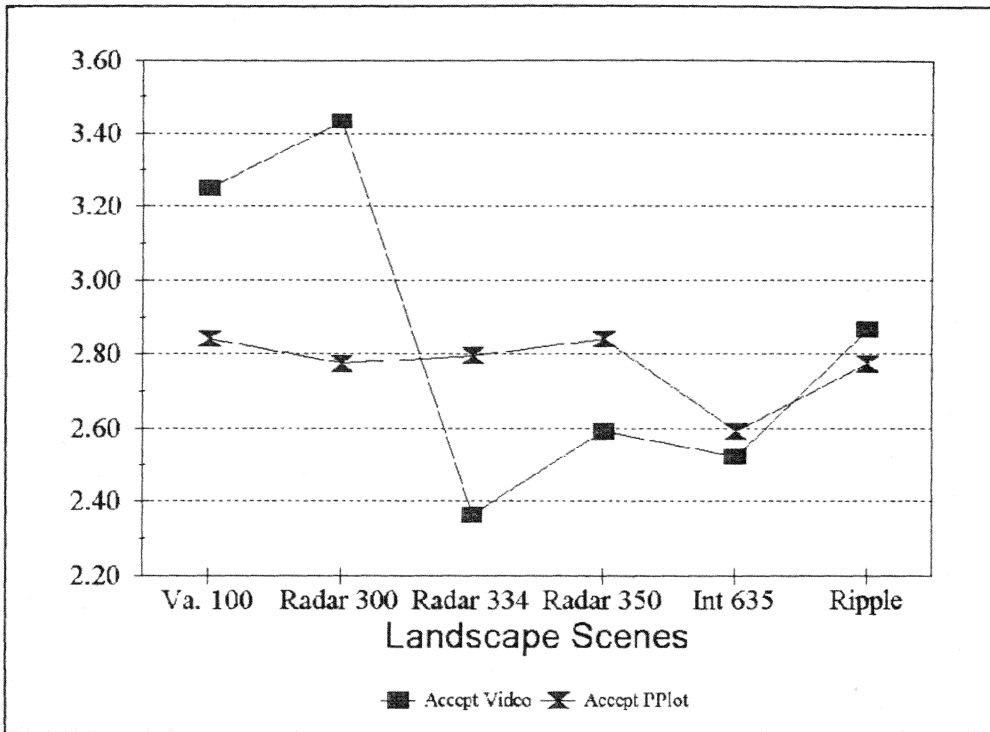


Figure 5. Acceptability Ratings

TABLE 14. MEAN VALUES FOR THE ACCEPTABILITY RATINGS

SIMULATION METHOD	VIEWPOINT					
	VA100 CURVE (V1)	RADAR 300 (V2)	RADAR 334 (V3)	RADAR 350 (V4)	INT 635 (V5)	RIPPLE (V6)
	VIDEO CUT (S3)	3.250	3.432	2.364	2.591	2.523
P PLOT CUT (S5)	2.841	2.773	2.795	2.841	2.591	2.773

The Effect of Location on Preferences for Treatment Methods. Table 15 shows a significant main effect for location, indicating that some scenes were rated significantly higher or lower than others. This is not surprising, for although most of the unharvested scenes were similar in landscape character, the harvested simulations did vary with respect to the "visual magnitude" of the clearcut¹⁰.

TABLE 15. TEST FOR MAIN EFFECT: "LOCATION"

UNIVARIATE REPEATED MEASURE F-TEST					
Source	SS	DF	MS	F	P
Hypothesis	28.841	5	0.768	6.894	0.000
Error	175.705	210	0.837		
MULTIVARIATE TEST STATISTICS					
TEST	F-STATISTIC	DF	PROB		
Wilk's Lambda = 0.575	5.629	5, 38	0.001		
Pillai Trace = 0.425	5.629	5, 38	0.001		
Hotelling-Lawley Trace = 0.741	5.629	5, 38	0.001		

Figure 5 gives a clue to which scenes are most responsible for the variation in ratings. Examination of the Figure shows that the variation was mostly in the video simulations rather than in the perspective plots. This interaction between location and simulation method is statistically significant, as shown in the hypothesis test in Table 16. Reliability scores for the video and perspective plot acceptability ratings were 0.843 and 0.547, respectively.

¹⁰Visual magnitude is the apparent size of an object on the landscape. For more information on this study sidelight see Gobster and Schwenke, 1990.

TABLE 16. TEST FOR SIMULATION x LOCATION INTERACTION

UNIVARIATE REPEATED MEASURE F-TEST					
Source	SS	DF	MS	F	P
Hypothesis	16.999	5	3.4	4.054	0.002
Error	176.115	210	0.839		

MULTIVARIATE TEST STATISTICS			
TEST	F-STATISTIC	DF	PROB
Wilk's Lambda = 0.615	4.750	5, 38	0.002
Pillai Trace = 0.385	4.750	5, 38	0.002
Hotelling-Lawley Trace = 0.625	4.750	5, 38	0.002

Group Differences in Acceptability Ratings. Participants' ratings were partitioned into various groupings to examine whether demographic, background, or attitudinal factors might be associated with rating differences. The main effects of these tests are shown in Table 17.

TABLE 17. TEST OF MAIN EFFECTS FOR GROUPING FACTORS

COMPAT (HARVESTING IS/ISN'T COMPATIBLE WITH LANDSCAPE)					
Source	SS	DF	MS	F	P
Hypothesis	29.606	1	29.606	7.260	0.012
Error	114.175	28	4.078		

SEX (MALE - FEMALE)					
Source	SS	DF	MS	F	P
Hypothesis	3.658	1	3.658	0.655	0.423
Error	229.101	41	5.588		

YRS LIVED (LESS THAN 5 - MORE THAN 5)					
Source	SS	DF	MS	F	P
Hypothesis	0.911	1	0.911	0.161	0.69
Error	231.849	41	5.655		

TABLE 17. (Cont.)

GROUP TYPE (CLUB vs. STUDENTS)					
Source	SS	DF	MS	F	P
Hypothesis	5.668	1	5.668	1.031	0.316
Error	230.847	42	5.496		

SEECUT (HAVE/HAVEN'T SEEN TIMBER HARVESTING PREVIOUSLY)					
Source	SS	DF	MS	F	P
Hypothesis	0.164	1	0.164	0.029	0.866
Error	232.595	41	5.673		

The only variable that showed up as statistically significant in these analyses was "compatibility." Examination of the mean score ratings for these two subgroups showed that those who felt timber harvesting was incompatible with what they like about this landscape tended to rate scenes lower than those who stated timber harvesting was compatible. Figures 6 and 7 are plots of the mean acceptability scores between "compatible" and "incompatible" groups for the two simulation types. The parallel lines indicate a main effect, with the difference between ratings averaging about a half of a point on a 5 point scale. There were no significant interactions between any of the subgroups and acceptability ratings.

Reliabilities for the various subgroup ratings of acceptability were: Group Type (Club 0.765, Students 0.707); Background (Never Seen Timber Harvesting 0.537, Seen Timber Harvesting 0.691), Attitude toward Harvesting (Incompatible 0.291, Compatible 0.540); Gender (Male 0.727, Female 0.418); Years lived in Area (5 or less 0.558; more than 5, 0.685).

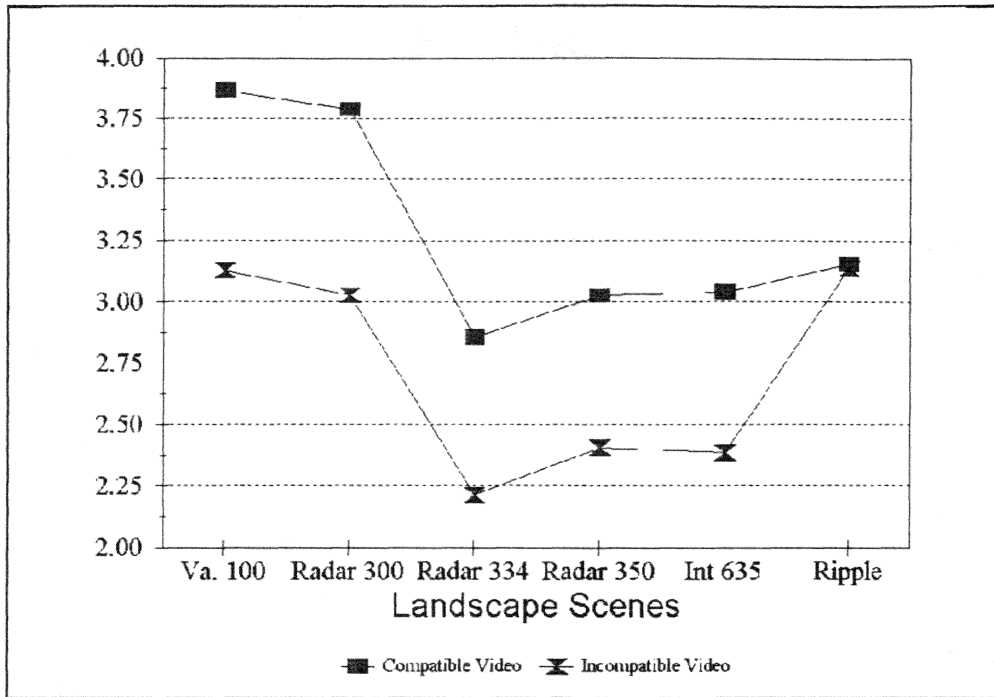


Figure 6. Video Acceptability Ratings/Compatibility

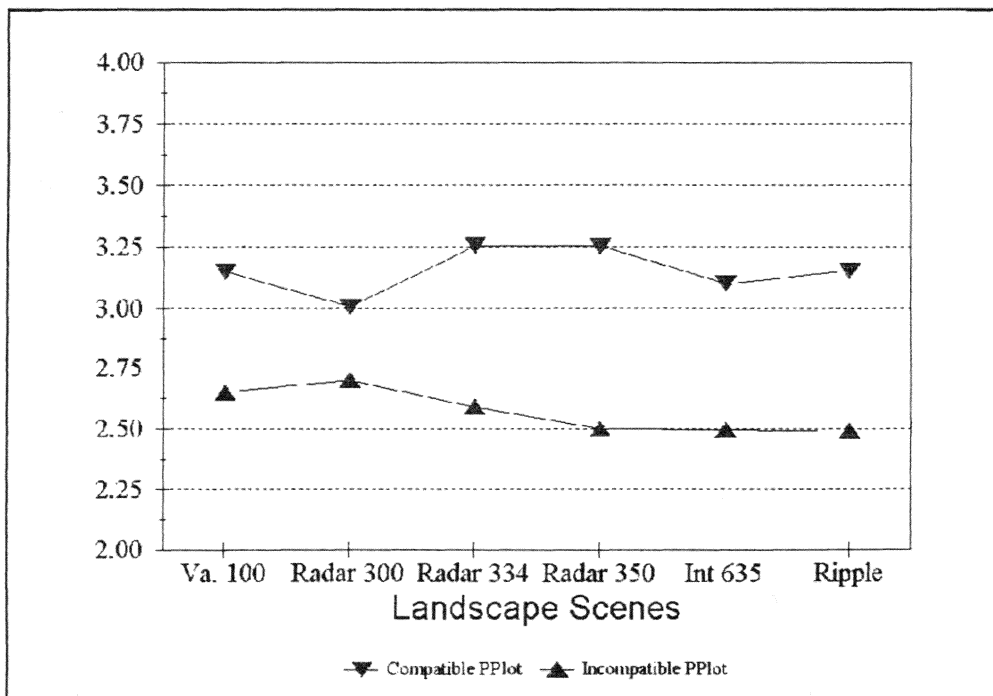


Figure 7. PPlot Acceptability Ratings/Compatibility

COMPARISON OF PREFERENCE AND ACCEPTABILITY RATINGS

The final research question was an examination of the differences between preference and acceptability ratings. The repeated measures ANOVA design for this question included a third trial factor for "rating type." Although the main effect of this analysis was significant (Table 18), this information is not particularly useful because they are distinctly different concepts. The correlation between measures across a set of scenes provides more useful information. The simple correlation was $r = 0.26$, which is low but is not a very reliable measure due to the small number of scenes (6) in the sample.

TABLE 18. TEST OF MAIN EFFECTS FOR RATING

COMPAT (HARVESTING IS/ISN'T COMPATIBLE WITH LANDSCAPE)					
Source	SS	DF	MS	F	P
Hypothesis	399.153	1	399.153	6.72	0.013
Error	2375.989	40	59.400		

Perhaps more interesting and useful is the test of interactions between rating types and the other trial factors. Table 19 shows significant rating x location and rating x treatment interactions, as well as a two-way rating X treatment x location interaction.

TABLE 19. INTERACTIONS BETWEEN RATINGS AND OTHER TRIAL FACTORS

Test of Rating x Simulation Interaction:					
UNIVARIATE REPEATED MEASURE F-TEST					
Source	SS	DF	MS	F	P
Hypothesis	545.146	1	545.146	23.734	0.000
Error	918.759	40	22.969		

TABLE 19. (Cont.)

Test of Rating x Location Interaction:					
UNIVARIATE F-TESTS					
Variable	SS	DF	MS	F	P
1	2857.085	1	2857.085	13.091	0.001
Error	8730.058	40	218.251		
2	905.254	1	905.254	3.170	0.083
Error	11421.889	40	285.547		
3	2630.676	1	2630.676	4.325	0.044
Error	24332.658	40	608.316		
4	97.421	1	97.421	1.627	0.209
Error	2394.865	40	59.872		
5	3178.277	1	3178.277	4.994	0.031
Error	25455.342	40	636.384		
MULTIVARIATE TEST STATISTICS					
TEST	F-STATISTIC	DF	PROB		
Wilk's Lambda = 0.606	4.679	5, 36	0.002		
Pillai Trace = 0.394	4.679	5, 36	0.002		
Hotelling-Lawley Trace = 0.650	4.679	5, 36	0.002		

TABLE 19. (Cont.)

Test of Rating x Location x Simulation Interaction:					
UNIVARIATE F-TESTS					
Variable	SS	DF	MS	F	P
1	123.431	1	123.431	0.792	0.379
Error	6235.141	40	155.879		
2	3015.543	1	3015.543	11.633	0.001
Error	10368.934	40	259.223		
3	30.769	1	30.769	0.098	0.756
Error	12621.135	40	315.528		
4	213.354	1	213.354	2.146	0.151
Error	3976.265	40	99.407		
5	20.232	1	20.232	0.031	0.862
Error	26288.244	40	657.206		
MULTIVARIATE TEST STATISTICS					
TEST	F-STATISTIC	DF	PROB		
Wilk's Lambda = 0.740	2.534	5, 36	0.046		
Pillai Trace = 0.260	2.534	5, 36	0.046		
Hotelling-Lawley Trace = 0.352	2.534	5, 36	0.046		

Plots of the data are shown in Figures 8 and 9. The rating x location interaction is apparent in the Figures, where ratings of acceptability for the video and perspective plot treatments jump around from scene to scene, while the plots for the preference ratings stay relatively flat. This evidence suggests that ratings of acceptability may be more sensitive to the particular scenes included as stimuli. As mentioned previously, clearcuts in some scenes had higher visual magnitudes than in others, and because people's attention was focused on the acceptability of timber harvesting they may have been more discriminating toward the scenes.

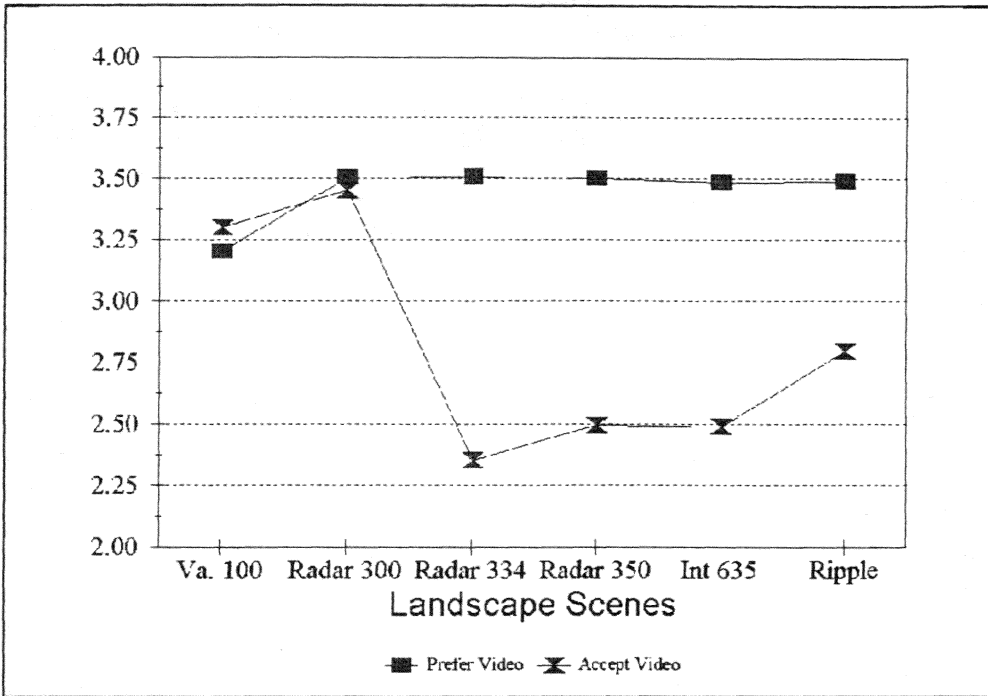


Figure 8. Video Ratings

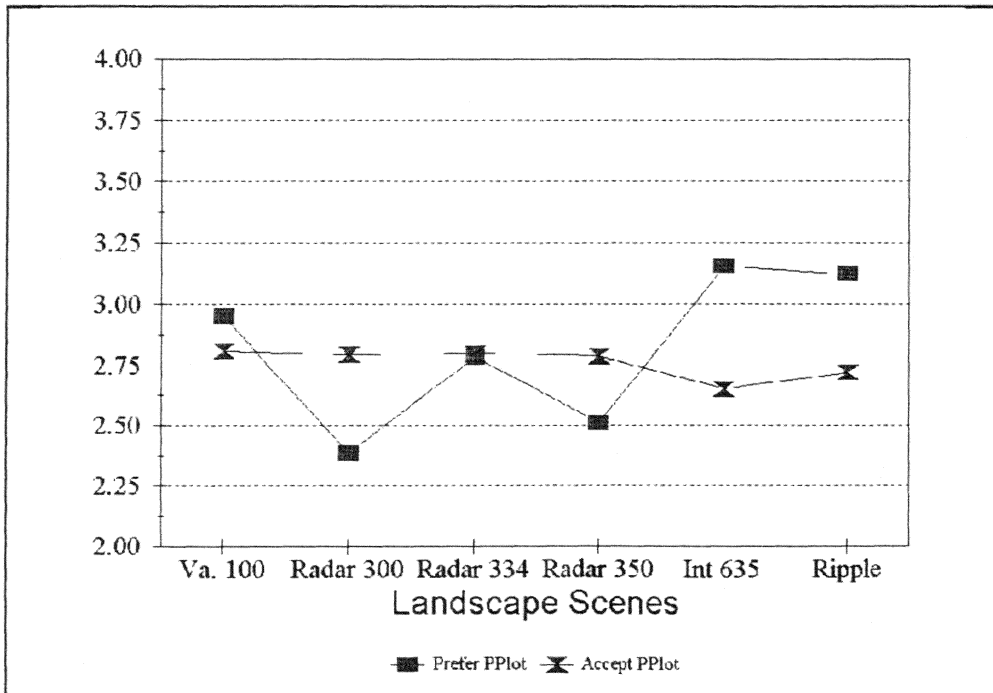


Figure 9. PPlot Ratings

The difference between preference and acceptability ratings appears to be greater for the video treatments, and is probably why the rating x treatment interaction was statistically significant. Clearcut simulations done with the video imaging were more obvious than were the perspective plot clearcuts; the former showed higher color contrast between tree and ground vegetation, while the latter merely showed an outline of the cut.

Finally, the significance of the rating x location x treatment interaction shows that the combined effects of different simulation methods and location can influence ratings of acceptability and preference differently. The multivariate test statistics were barely significant for this particular analysis, therefore, and these findings should be interpreted with caution.

Analysis of Attitudes and Background:

The issues brought forth in this section of the questionnaire can be lumped into four categories; 1)those dealing with awareness of US Forest Service management practices, 2)those dealing with attitudes about timber harvesting and aesthetics, 3)those dealing with attitudes about public involvement, and 4)those dealing with demographic data.

Awareness of US Forest Service Management Practices. In reviewing the first five questions, it becomes apparent that the degree to which the two groups were aware of US Forest Service management practices is lacking. The majority visit the Jefferson National Forest rarely or never. This may account for some of their lack of familiarity, but in the following question, a good portion feels that the Jefferson National Forest is managed better than average, although a fairly large group does not know. Only about half know that the US Forest Service has management plans for the National Forests and that visual management is considered in these plans. The final question in this series deals with how well the

participants believe that public agencies follow their management plans. The response leans heavily toward the negative side on this question, even though in response to question two, a good portion of the participants felt that the Jefferson National Forest is managed well. What these seemingly contrasting responses state is difficult to decipher. It may be that these groups do not trust public agencies, but feel that the Jefferson National Forest is an exception. The fact remains, though, that the respondents possessed a general lack of awareness of US Forest Service management practices.

Attitudes toward Timber Harvesting. With the growing environmental concerns of the 1980's and 1990's, one would suspect that responses to this section would reflect markedly negative attitudes toward timber harvesting. On the contrary, this section depicts a tempered attitude. It appears that most of the respondents felt that timber harvesting is important to the area's economy. Likewise a majority felt that timber harvesting is compatible with their favorite characteristics of the regional landscape. Even so, the groups did show a very strong sensitivity to the appearance of timber harvesting. The respondents overwhelmingly felt that appearance was important from a scenic parkway. Other locations ranked from homes, to campsites and trails, to major highways, down to local roads, in order of importance. It is interesting to note that homes have such a high sensitivity. In those National Forests with a mix of land ownership, this could pose a formidable task to ascertain that units would have low visual impact from the homes from which they may be visible.

Attitudes about the Importance of Public Involvement. Both groups felt that public involvement was important in both the US Forest Service decision-making process and in assessing the appearance of timber harvesting. However, nearly 3/4 of the respondents were unfamiliar with the procedures that the US Forest Service goes through to determine the location and design of timber harvests. While it may not be necessary for the public to know the details of the procedures, these respondents indicated that they feel that the public's

involvement is important in these procedures. And since as earlier indicated, they lack an awareness of US Forest Service management practices, the word must be gotten out as to how they can participate, if they wish to be involved.

Tables 20 and 21 show the results of part c of the questionnaire, that was discussed above.

TABLE 20. ATTITUDE AND DEMOGRAPHIC DATA

How often visit Jefferson N.F.?				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-Never	16	16	30.8	30.8
2	11	27	21.2	51.9
3	13	40	25.0	76.9
4	6	46	11.5	88.5
5-Often	6	52	11.5	100.0

How well is Jefferson N.F. managed?				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-Poorly	1	1	1.9	1.9
2	2	3	3.8	5.8
3	9	12	17.3	23.1
4	17	29	32.7	55.8
5-Well	4	33	7.7	63.5
8-Don't know	19	52	36.5	100.0

Awareness of Management Plan?				
Scale	Count	Cum. Count	Percent	Cum. Percent
Yes	21	21	40.4	40.4
No	31	52	59.6	100.0

TABLE 20. (Cont.)

Awareness of Visual Management concerns?				
Scale	Count	Cum. Count	Percent	Cum. Percent
Yes	22	16	30.8	30.8
No	52	27	21.2	51.9

Believe public agencies follow Management Plans?				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-Not at all	0	0	0.0	0.0
2	15	15	30.0	30.0
3	28	43	56.0	86.0
4	7	50	14.0	100.0
5-Very much	0	50	0.0	100.0

Have you seen timber harvests?				
Scale	Count	Cum. Count	Percent	Cum. Percent
Yes	26	26	50.0	50.0
No	26	52	50.0	100.0

How important is timber harvesting to area economy?				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-Not at all	0	0	0.0	0.0
2	7	7	13.7	13.7
3	21	28	41.2	54.9
4	17	45	33.3	88.2
5-Very much	6	51	11.8	100.0

TABLE 20. (Cont.)

How important is the view from home?				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-Not at all	0	0	0.0	0.0
2	1	1	1.9	1.9
3	6	7	11.5	13.5
4	10	17	19.2	32.7
5-Very much	35	52	67.3	100.0

How important is the view from trails?				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-Not at all	0	0	0.0	0.0
2	1	1	1.9	1.9
3	3	4	5.8	7.7
4	17	21	32.7	40.4
5-Very much	31	52	59.6	100.0

How important is the view from highways?				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-Not at all	0	0	0.0	0.0
2	2	2	3.8	3.8
3	15	17	28.8	32.7
4	15	32	28.8	61.5
5-Very much	20	52	38.5	100.0

TABLE 20. (Cont.)

How important is the view from parkways?				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-Not at all	0	0	0.0	0.0
2	0	0	0.0	0.0
3	1	1	1.9	1.9
4	9	10	17.3	19.2
5-Very much	42	52	80.8	100.0

How important is the view from campsites?				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-Not at all	0	0	0.0	0.0
2	0	0	0.0	0.0
3	5	5	9.6	9.6
4	16	21	30.8	40.4
5-Very much	31	52	59.6	100.0

How important is the view from local roads?				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-Not at all	0	0	0.0	0.0
2	6	6	11.5	11.5
3	13	19	25.0	36.5
4	19	38	36.5	73.1
5-Very much	14	52	26.9	100.0

TABLE 20. (Cont.)

How important is public involvement in decision making?				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-Not important	0	0	0.0	0.0
2	2	2	3.9	3.9
3	10	12	19.6	23.5
4	24	36	47.1	70.6
5-Very important	15	51	29.4	100.0

How familiar with harvest design/location procedures?				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-Not familiar	38	38	73.1	73.1
2	7	45	13.5	86.5
3	3	48	5.8	92.3
4	2	50	3.8	96.2
5-Very familiar	2	52	3.8	100.0

How important is public involvement in determining the appearance of timber harvests?				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-Not important	1	1	2.0	2.0
2	3	4	5.9	7.8
3	12	16	23.5	31.4
4	21	37	41.2	72.5
5-Very important	14	51	27.5	100.0

TABLE 20. (Cont.)

Is timber harvesting compatible with your favorite characteristics of this area's landscape?				
Scale	Count	Cum. Count	Percent	Cum. Percent
Yes	25	25	64.1	64.1
No	14	39	35.9	100.0

Age				
Scale	Count	Cum. Count	Percent	Cum. Percent
18-25	34	34	66.7	66.7
26-35	5	39	9.8	76.5
36-45	7	46	13.7	90.2
46-55	4	50	7.8	98.0
56-65	1	51	2.0	100.0
66 and above	0	51	0.0	0.0

Sex				
Scale	Count	Cum. Count	Percent	Cum. Percent
Female	15	15	29.4	29.4
Male	36	51	70.6	100.0

Education				
Scale	Count	Cum. Count	Percent	Cum. Percent
High School	3	3	5.8	5.8
College	45	48	86.5	92.3
Post-graduate	3	51	5.8	98.1

TABLE 20. (Cont.)

Years lived in Appalachian region of Virginia				
Scale	Count	Cum. Count	Percent	Cum. Percent
1-5	23	23	45.1	45.1
6-10	1	24	2.0	47.1
11-20	9	33	17.6	64.7
21-30	8	41	15.7	80.4
30+	9	50	17.6	98.0

Occupation				
Scale	Count	Cum. Count	Percent	Cum. Percent
Student	34	34	70.8	70.8
Professional	14	48	29.2	100.0

Member of environmental group				
Scale	Count	Cum. Count	Percent	Cum. Percent
Yes	8	8	15.7	15.7
No	43	51	84.3	100.0

TABLE 21. MEAN SCORES ON QUESTIONNAIRE DATA

Question	N of cases	Minimum	Maximum	Mean	Standard Dev.
SUBNO*	52	1.000	52.000	26.500	15.155
GROUPNO*	52	1.000	2.000	1.269	0.448
VISIT	52	1.000	5.000	2.519	1.350
GOODMGMT	52	1.000	8.000	5.231	2.237
KNOWPLAN	52	1.000	2.000	1.596	0.495
KNOWVMS*	52	1.000	2.000	1.577	0.499
USEPLAN	50	2.000	4.000	2.840	0.650
SEECUT*	52	1.000	2.000	1.500	0.505
ECONOMY	51	2.000	5.000	3.431	0.878
HOMES	52	2.000	5.000	4.519	0.779
TRAILS	52	2.000	5.000	4.500	0.700
HWYS	52	2.000	5.000	4.019	0.918
PKWAYS	52	3.000	5.000	4.788	0.457
CAMPS	52	3.000	5.000	4.500	0.672
ROADS	52	2.000	5.000	3.788	0.977
PUBINV	51	2.000	5.000	4.020	0.812
FAMILIAR	52	1.000	5.000	1.519	1.038
VISIMP	51	1.000	5.000	3.863	0.960
COMPAT*	39	1.000	2.000	1.359	0.486
AGE	51	18.000	56.000	24.196	10.208
SEX*	51	1.000	2.000	1.706	0.460
EDUC*	52	1.000	9.000	2.135	1.030
YRS LIVED	51	1.000	6.000	2.647	1.671
JOBCLASS*	48	1.000	3.000	2.042	0.743
ENVGROUP*	51	1.000	2.000	1.843	0.367

* Mean scores are not meaningful, eg. binary data or nominal categories.

Conclusions and Recommendations

With increasing public involvement in the management of the natural resources of this country, communication of how proposed projects will affect our environment will also need to improve. Computer technology used to produce simulations of projects will, no doubt, be an important tool for communicating the effects on the aesthetics of an area.

Just how computer simulations might be used as a communication tool in displaying the visual impacts of timber harvests was one objective of this study. Due to a lack of availability of slides of actual harvests, the simulations depicting harvests could not be compared with them. So, while there was no baseline to assess the accuracy of the images shown, the evidence does suggest that the two types of computer simulations used within this study do communicate different information to the viewers. Certainly, differences were expected, however, the ways in which they manifested themselves were not.

As expected, the video images without cuts "shadowed" the unadulterated slides in the preference testing. The ratings varied from scene to scene apparently based upon the landscapes themselves and also other features in the landscapes such as wires, buildings, clouds, distance, color contrast, etc. The similarities in the preference ratings between the unadulterated slides and the video images without cuts indicate that the video images do provide a surrogate role for slides when people are being asked to rate their preferences for landscape scenes.

However, the same would not hold true for the perspective plot images. In the test for preference rating, the perspective plots showed a low variability in their ratings and the images with the harvest units were rated higher than those without the units shown. It appears that the differences in the perspective plot scenes were not as easy to discern and

that the units actually added something to the scenes that made them more preferable. Whether this can be attributed to further complexity of the scenes or to the notion that trees were present when the units were shown was not determined in this research project. Since the factor(s) to which the participants responded is unknown, using perspective plots in a management setting as a communication tool would lead the resource manager to the incorrect conclusion that people actually prefer the appearance of harvest units over the same landscape without harvest units.

However, some perspective plot scenes may have been rated higher than the corresponding slide or video due to the lack of wires, buildings, roads or other landscape features that were not portrayed in the perspective plots. In this case, the respondents may not have been showing their preference for the landscape as much as that they did not prefer to have building, wires, etc. on the landscape. To test how much difference these elements create in the ratings, research showing unadulterated slides and video images without wires, buildings, etc., and perspective plots would need to be done. In the mean time, however, resource managers should be aware that these elements do affect ratings. Again, this could lead the manager to the conclusions that a group may not like a proposed alternative when perhaps they are actually reacting to the presence of other features on the landscape.

This does not mean that they should never appear in the depictions of proposed projects. If a resource manager is asking the public to rate their preference between an unadulterated slide and a video image, the same elements should appear in both, unless the project involved the removal of those objects. For example, in comparing a slide of a scenic byway that currently has powerlines overhead versus a video image of the same scene with the powerlines removed from the corridor, obviously the elements would change. In this case, the manager should expect a change in the ratings, most probably showing a preference for the landscape without the powerlines as is suggested by the ratings received by the

perspective plot images in this study.

While the results suggest that when rating for preference, video images can be useful, the same does not hold true for acceptability ratings. For the preference ratings, the slides, video images and perspective plots without harvest units could be compared and thus provide some indication of how well the simulation represented the actual landscape. With the acceptability ratings, because there was no baseline of an actual harvest unit depicted to compare with the simulations, the same judgement, on the usefulness of video images, cannot be made.

The acceptability ratings for the video images showed greater variability, yet the simulations themselves also were highly variable in their characteristics. However, the perspective plots, again, showed lower variability in ratings. So, as in the preference tests, the respondents may well have picked up on the elements in the video images that were not present in the perspective plots, namely, the features of the landscape alteration. Any number or combination of features may have caused the ratings to vary. Respondents may have reacted to the shape of the proposed cut, the visual magnitude of it, the color contrast, or all these factors. As the research does not indicate which of these contributed to their rating of the video scenes, it would be remiss to suggest that video images of proposed harvest units be used to ask people to rate their acceptance of them in a practical setting. For example, should the color contrast of the proposed landscape alteration be noticeably greater or less than what the actual result will be, not only will the resource manager possibly come to an incorrect conclusion on the visual impacts of the project, but the public that viewed the simulations may no longer trust or believe in the credibility of the manager.

While this project focused mainly on the use of computer images as a communication tool, it also examined how peoples' knowledge and attitudes might influence how they respond

to the images. Resource managers should be aware that people who are familiar with a landscape and the economic base it provides, often feel that resource management activities are compatible with the landscape and therefore are more likely to find such activities more acceptable than those who do not share this feeling of compatibility.

The research further suggests that the U.S. Forest Service has not succeeded in communicating to the public their methods of planning at the Forest or project level, or how the public involvement process works. However, it does show that people do want to be involved and feel that it is important to be able to be involved. Since it appears that current communication practices are not working for the agency, further research is needed by communication experts, planners, landscape architects and others to aid in an overall improvement in communication between the agency and the public it serves.

One other piece of information that this research uncovered was the importance of viewer location. The U.S. Forest Service Visual Management System (VMS) incorporates viewer location, primarily from roads, recreation sites, or from airplanes. While the evidence was in agreement with roads, trails, campgrounds, one viewer location not emphasized by VMS is home. Since almost seventy percent of the respondents felt aesthetics of projects visible from their homes was very important, those National Forests with a mixed ownership pattern need to do more than simply send out scoping letters to their adjacent landowners to communicate the potential effects of a project.

This thesis project further emphasizes the need for better communication between the public and the land management agencies, in this case the U.S. Forest Service. It shows that computer technologies can be applied in some instances and that further research needs to be developed to test the accuracy of the images prior to their widespread use in public involvement. Landscape Architects in the agency and in academia can play a significant role

in determining this.

Through their efforts and the agency's efforts to improve the quality of its communication with the public, the management of our National Forests will reflect the aesthetic values of America.

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APPENDICES

VISUAL SIMULATION QUESTIONNAIRE

VISUAL SIMULATION QUESTIONNAIRE

The purpose of this survey is to determine whether the visual representations, such as photographs, sketches, computer plots and video images, currently used to portray forest harvesting proposals can successfully communicate to a public group the nature of the alteration and how it will look once completed.

PART A

You will be shown slides of landscapes or visual representations of landscapes. Please indicate how much you feel you would like the landscape in each scene according to the following scale:

1=preferred not at all, 2=preferred a little, 3=preferred somewhat, 4=preferred quite a bit, 5=preferred very much.

1. 1 2 3 4 5 11. 1 2 3 4 5 21. 1 2 3 4 5

2. 1 2 3 4 5 12. 1 2 3 4 5 22. 1 2 3 4 5

3. 1 2 3 4 5 13. 1 2 3 4 5 23. 1 2 3 4 5

4. 1 2 3 4 5 14. 1 2 3 4 5 24. 1 2 3 4 5

5. 1 2 3 4 5 15. 1 2 3 4 5 25. 1 2 3 4 5

6. 1 2 3 4 5 16. 1 2 3 4 5 26. 1 2 3 4 5

7. 1 2 3 4 5 17. 1 2 3 4 5 27. 1 2 3 4 5

8. 1 2 3 4 5 18. 1 2 3 4 5 28. 1 2 3 4 5

9. 1 2 3 4 5 19. 1 2 3 4 5 29. 1 2 3 4 5

10. 1 2 3 4 5 20. 1 2 3 4 5 30. 1 2 3 4 5

PART B

Timber harvesting is depicted in each of the following slides. Assuming that this harvesting is taking place on public lands (National Forest) and is visible from a major highway, please indicate how visually acceptable you find each project according to the following scale:

1=not acceptable, 2=slightly unacceptable, 3=somewhat acceptable, 4=moderately acceptable, 5=very acceptable.

- | | | |
|---------------|---------------|---------------|
| 1. 1 2 3 4 5 | 11. 1 2 3 4 5 | 21. 1 2 3 4 5 |
| 2. 1 2 3 4 5 | 12. 1 2 3 4 5 | 22. 1 2 3 4 5 |
| 3. 1 2 3 4 5 | 13. 1 2 3 4 5 | 23. 1 2 3 4 5 |
| 4. 1 2 3 4 5 | 14. 1 2 3 4 5 | 24. 1 2 3 4 5 |
| 5. 1 2 3 4 5 | 15. 1 2 3 4 5 | 25. 1 2 3 4 5 |
| | | |
| 6. 1 2 3 4 5 | 16. 1 2 3 4 5 | 26. 1 2 3 4 5 |
| 7. 1 2 3 4 5 | 17. 1 2 3 4 5 | 27. 1 2 3 4 5 |
| 8. 1 2 3 4 5 | 18. 1 2 3 4 5 | 28. 1 2 3 4 5 |
| 9. 1 2 3 4 5 | 19. 1 2 3 4 5 | 29. 1 2 3 4 5 |
| 10. 1 2 3 4 5 | 20. 1 2 3 4 5 | 30. 1 2 3 4 5 |

FOREST SERVICE PLANNING PROCESS

3. How often do you visit the Jefferson National Forest?

Never - 1 2 3 4 5 - Often

4. How well managed do you believe the Jefferson National Forest is?

Poorly - 1 2 3 4 5 - Well Don't know _____

5. Are you aware that the Forest Service has a management plan (a program reflective of a mixture of activities that allow multiple use and protection of the Forest resources; fulfill legislative requirements; and address local, regional, and national issues) for the Jefferson National Forest? Y N

6. Are you aware that the Forest Service is concerned with the issue of "what timber harvests will look like" in their management plans? Y N

7. To what extent do you believe that public agencies actually follow their management plans?

Not at all - 1 2 3 4 5 - Very much

8. Have you ever seen timber harvesting? (prior to today's slide presentation) Y N

9. How important do you believe the timber industry is to the area's economy?

Not important - 1 2 3 4 5 - Very important

10. How much do you care that the appearance of timber harvesting be taken into consideration when seen from the following vantage points:

residence: Not at all - 1 2 3 4 5 - Very much

hiking trail: Not at all - 1 2 3 4 5 - Very much

major roadway: Not at all - 1 2 3 4 5 - Very much

scenic parkway: Not at all - 1 2 3 4 5 - Very much

campsite: Not at all - 1 2 3 4 5 - Very much

local road: Not at all - 1 2 3 4 5 - Very much

PUBLIC INVOLVEMENT:

11. How important do you believe public involvement (i.e., public hearings or meetings) should be in the Forest Service's decision-making process?

Not important - 1 2 3 4 5 - Very important

12. How familiar are you with the procedures for designing and locating timber harvesting areas in the landscape?

Not familiar - 1 2 3 4 5 - Very familiar

13. How important do you believe public involvement should be in determining the appearance of timber harvesting?

Not important - 1 2 3 4 5 - Very important

14. What characteristics do you especially like about the landscape of this region?

15. Is timber harvesting compatible with these characteristics?

Y, N If not, which characteristics are affected?

BACKGROUND INFORMATION:

Please check the appropriate response:

Age: 18-25, 26-35, 36-45, 46-55, 56-65, 66 and above.

Gender: M, F

Education: Primary, High School, College, Post-graduate

How long have you lived in the Appalachian region of Virginia?

1-5yr., 6-10yr., 11-20yr., 21-30yr., More than 30yr.

Occupation: _____

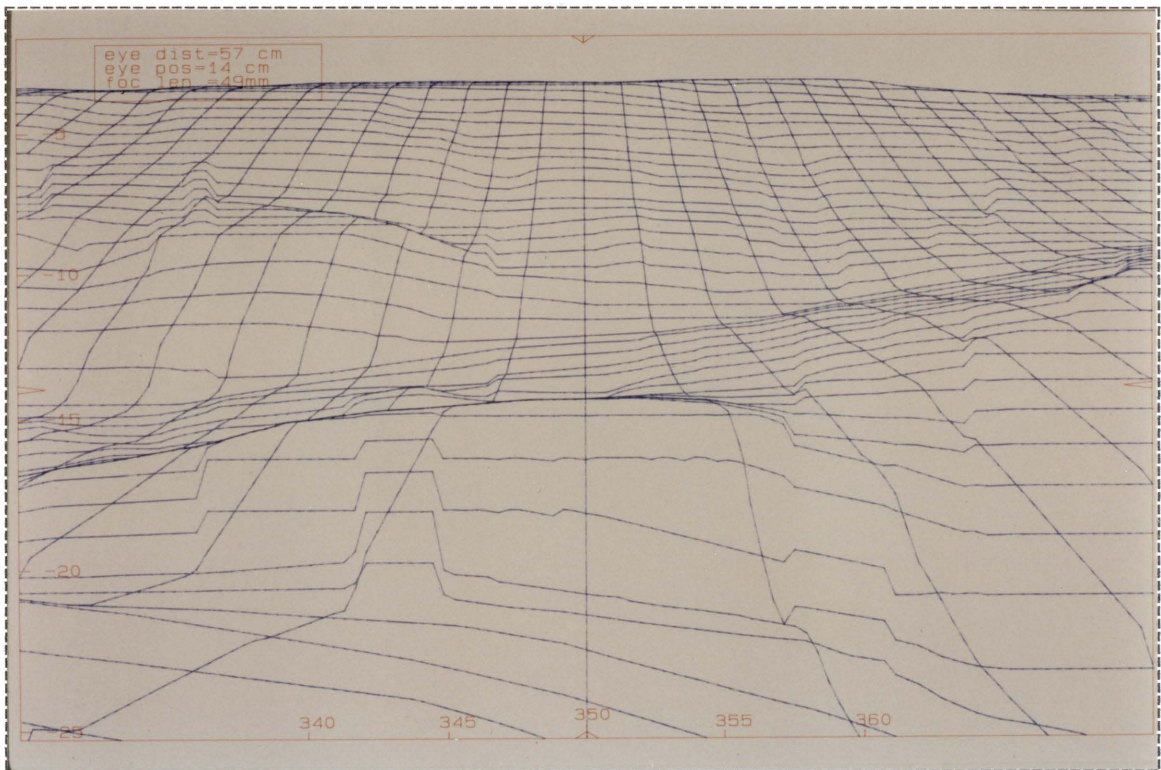
Member of environmental group or club? Y, N If yes, which

ones? _____

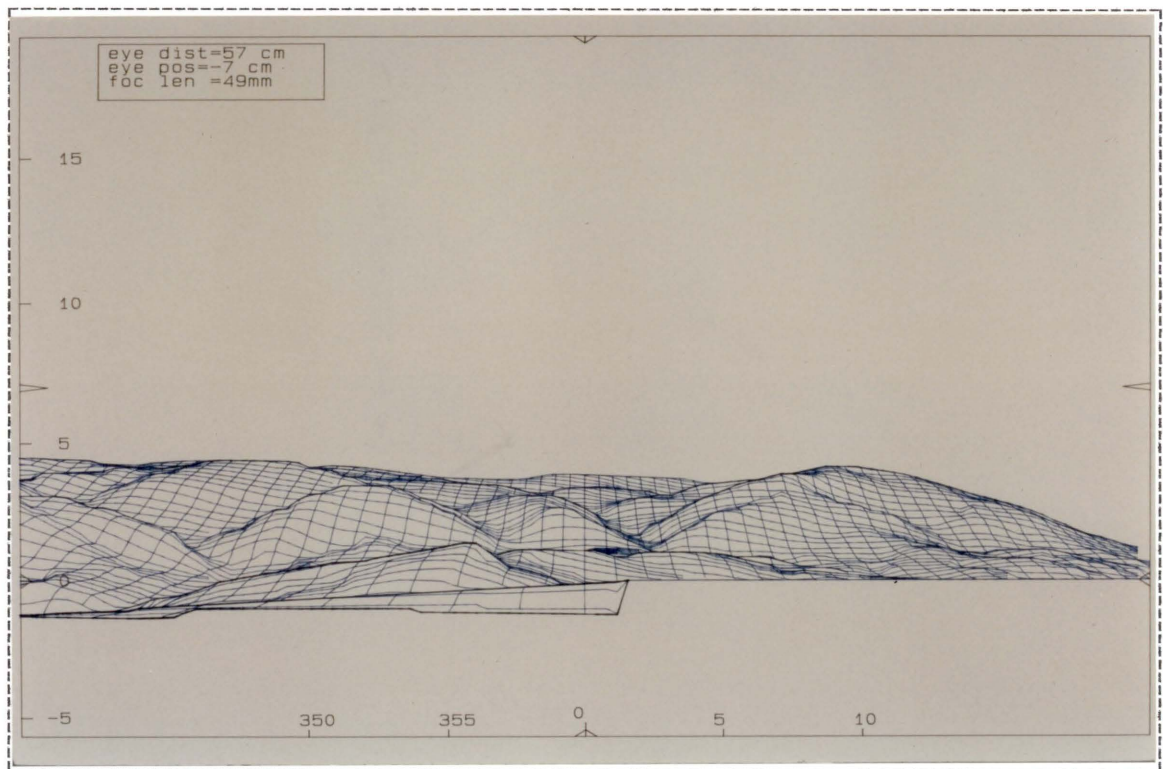
**PREFERENCE TEST
IMAGES**



1 VA 100 Curve - Video Image



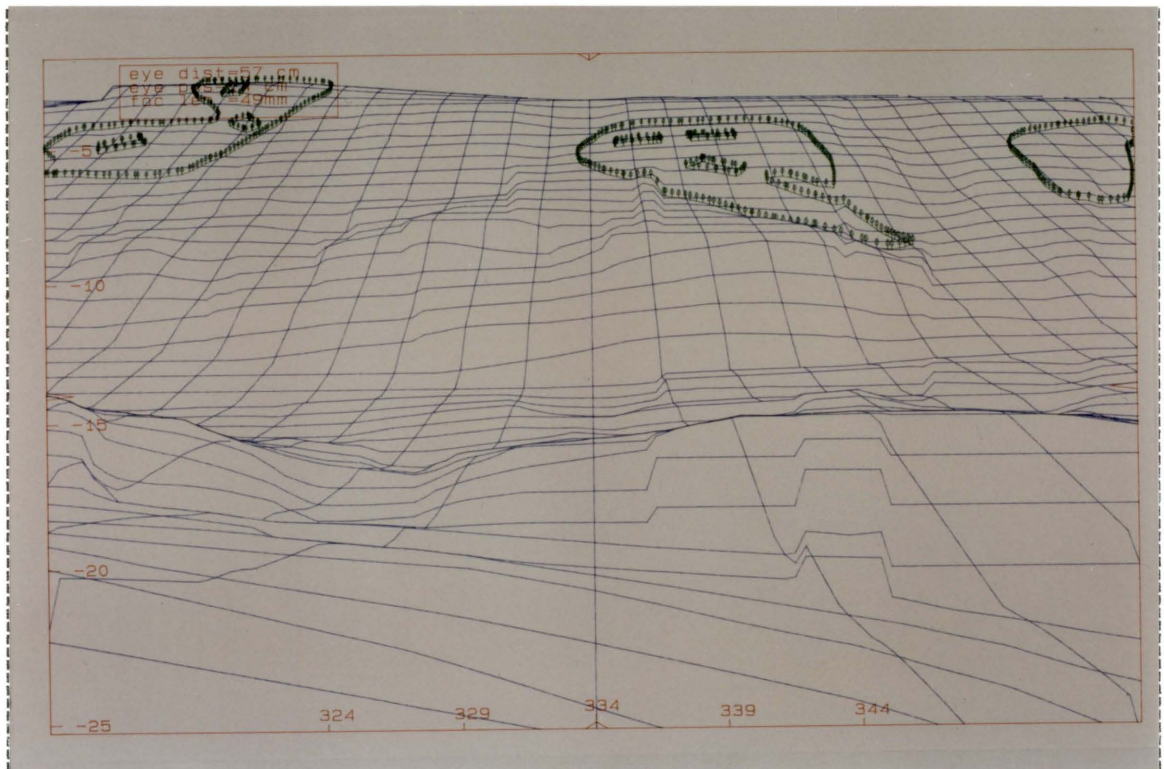
2 Radartower AZ 350 - PPlot



3 Ripplemead - PPlot



4 Radartower AZ 300 - Video cut



5 Radartower AZ 334 - PPlot Cut



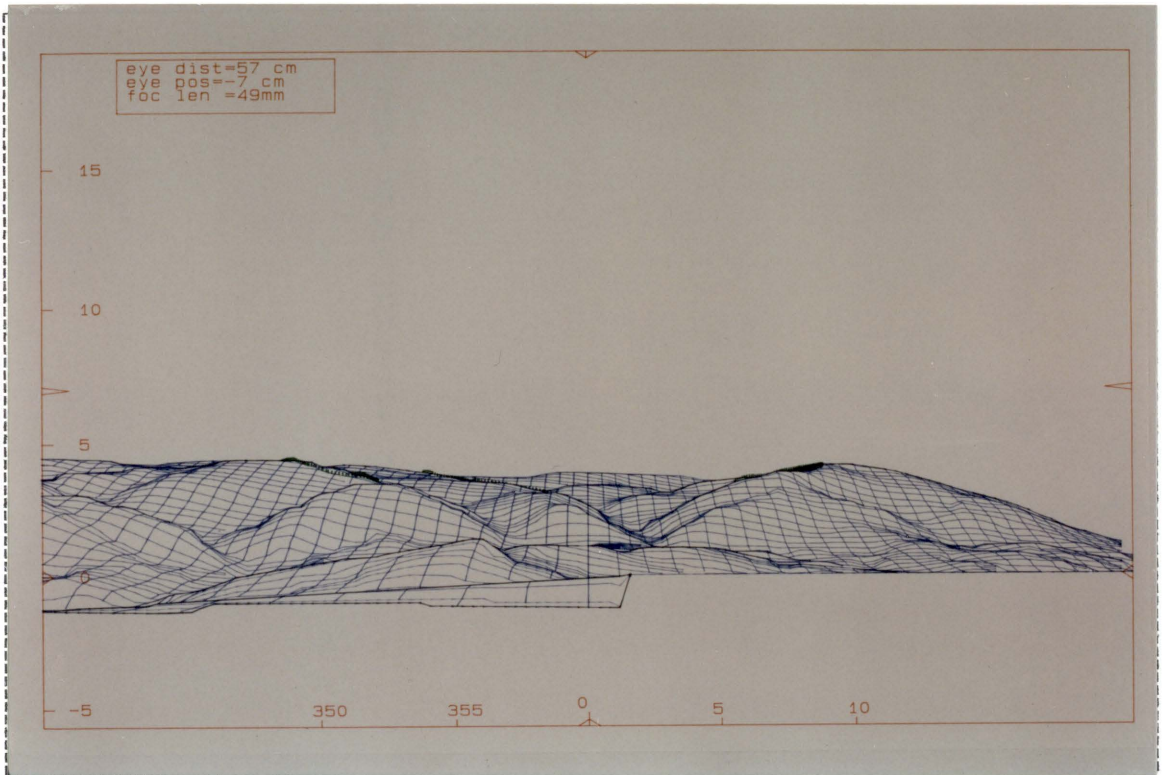
6 Radartower AZ 350 - Video cut



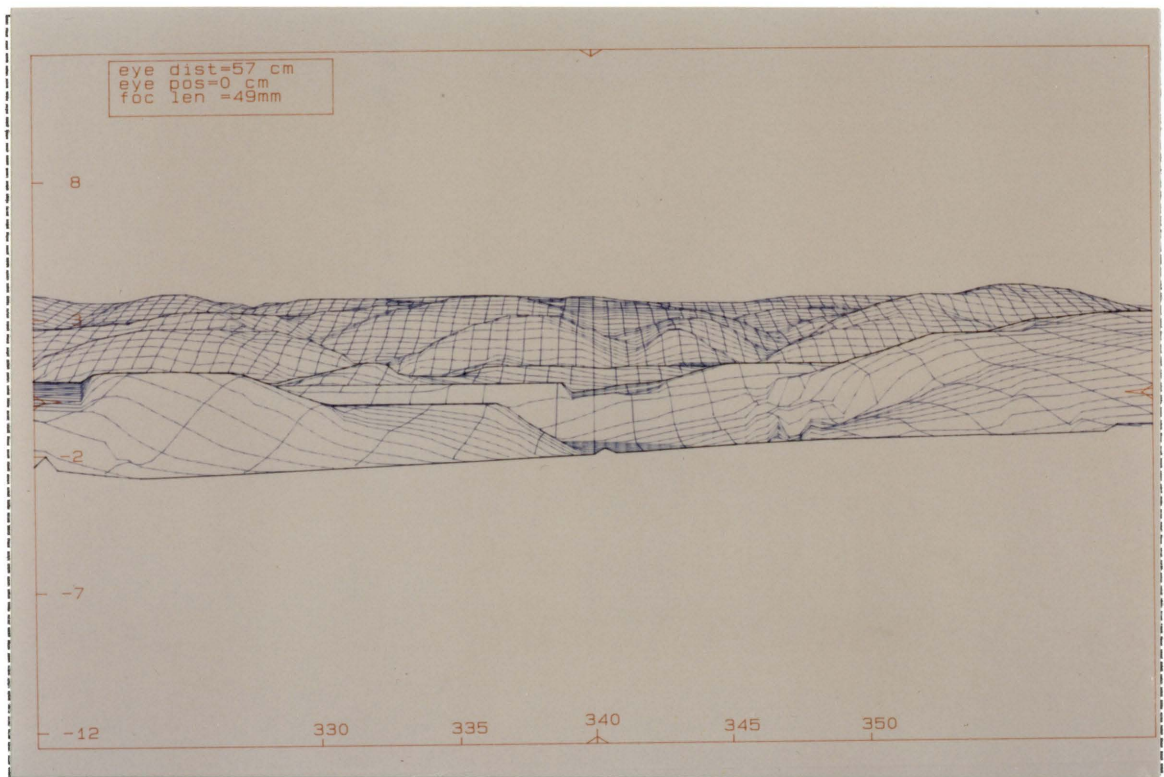
7 VA 100 Curve - Original Slide



8 635 Intersection - Video cut



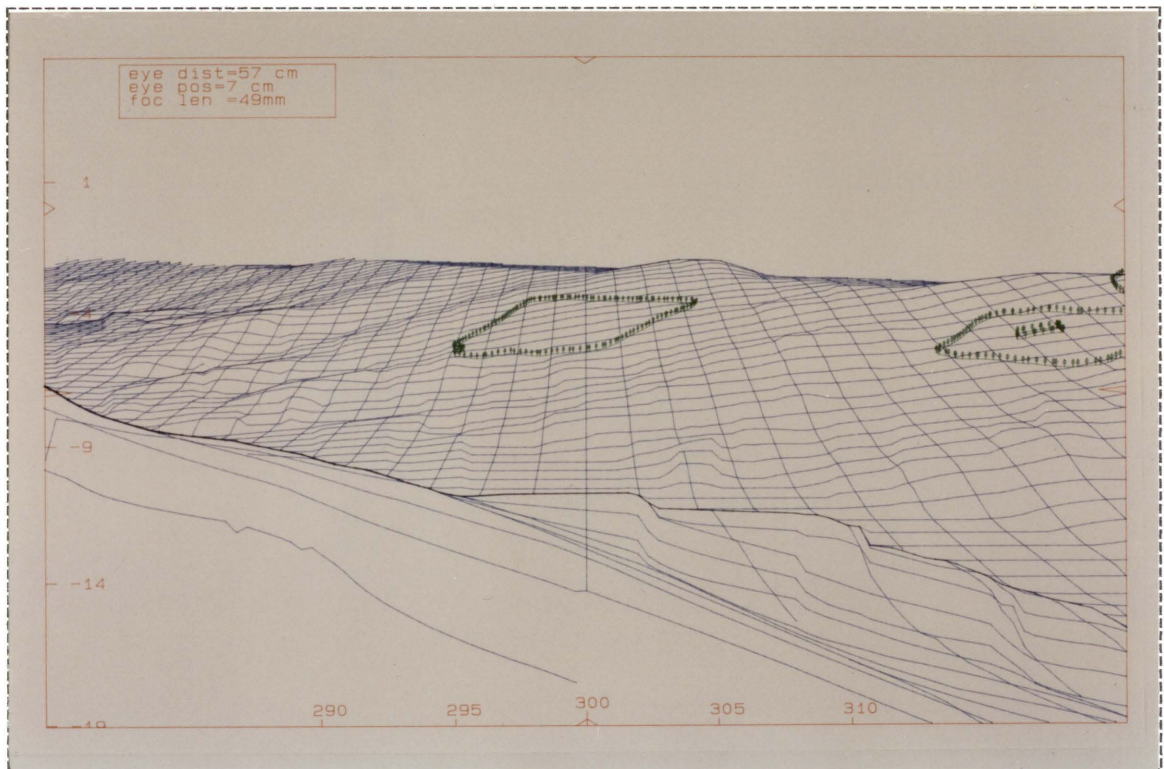
9 Ripplemead - PPlot cut



10 Bridge - PPlot



11 Radartower AZ 334 - Video Image



12 Radartower AZ 300 - PPlot cut



13 VA 100 Curve - Video cut



14 Radartower AZ 334 - Video cut



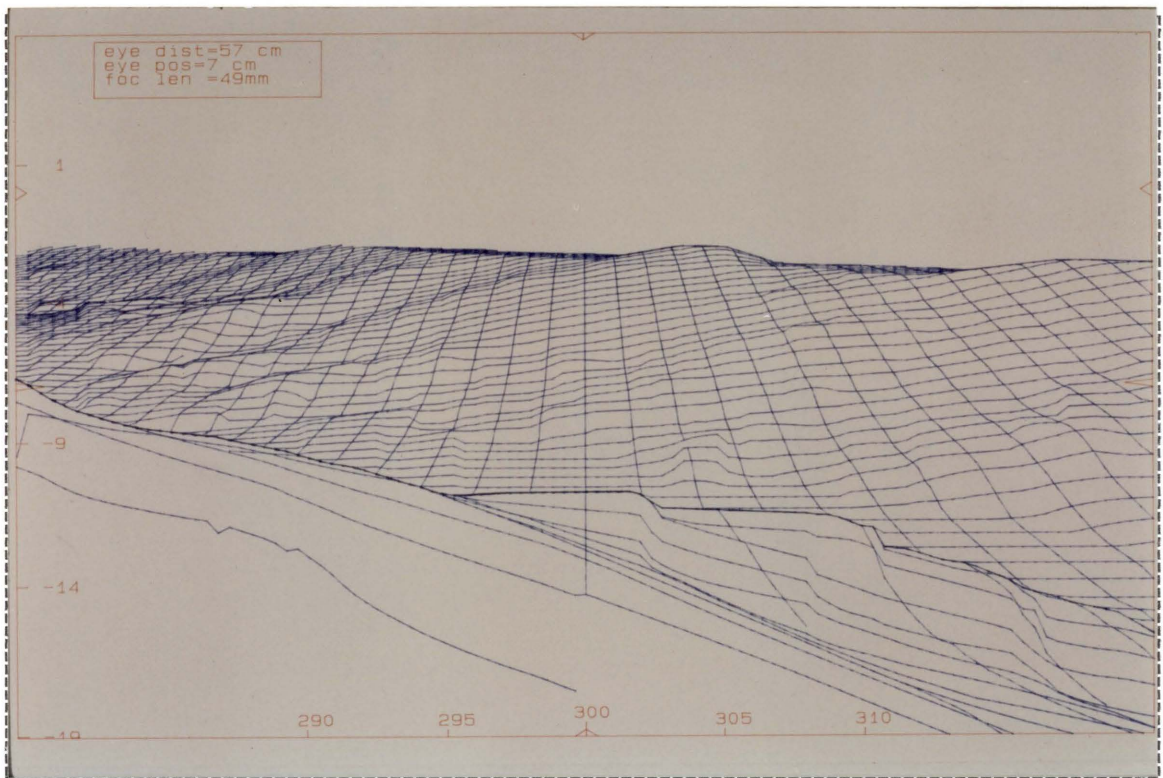
15 Radartower AZ 300 - Original Slide



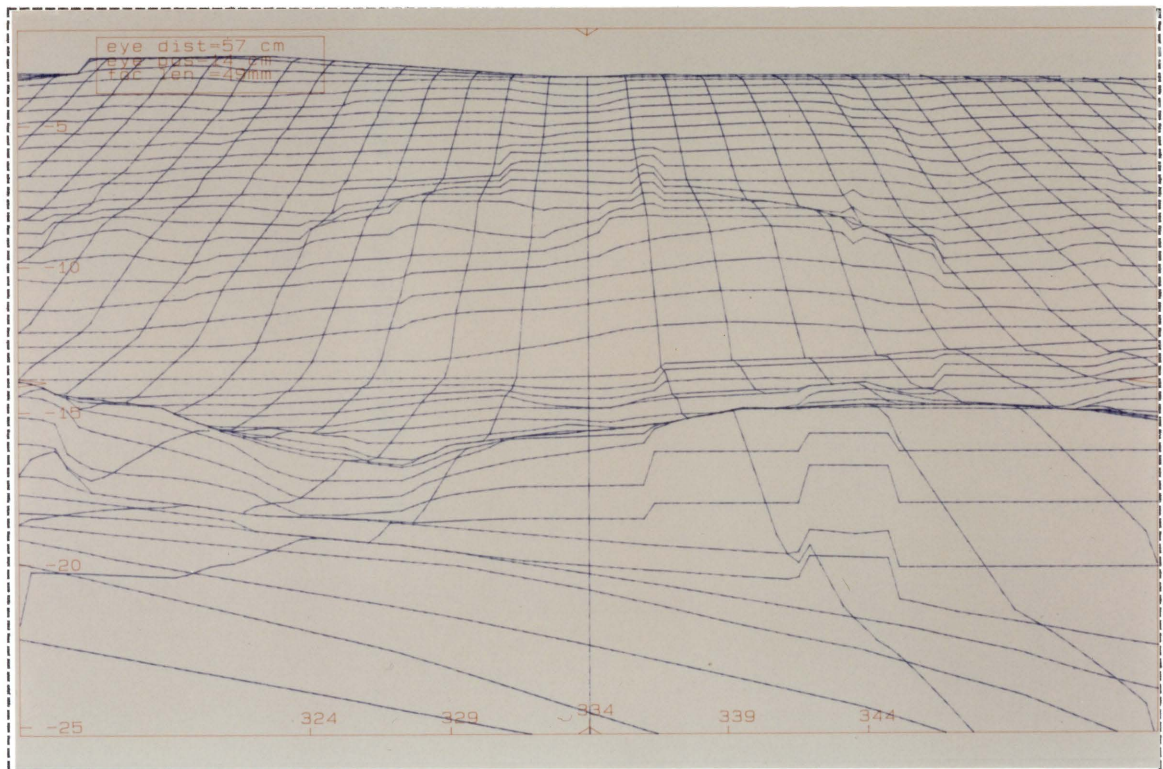
16 Radartower AZ 350 - Video Image



17 Ripplemead - Original Slide



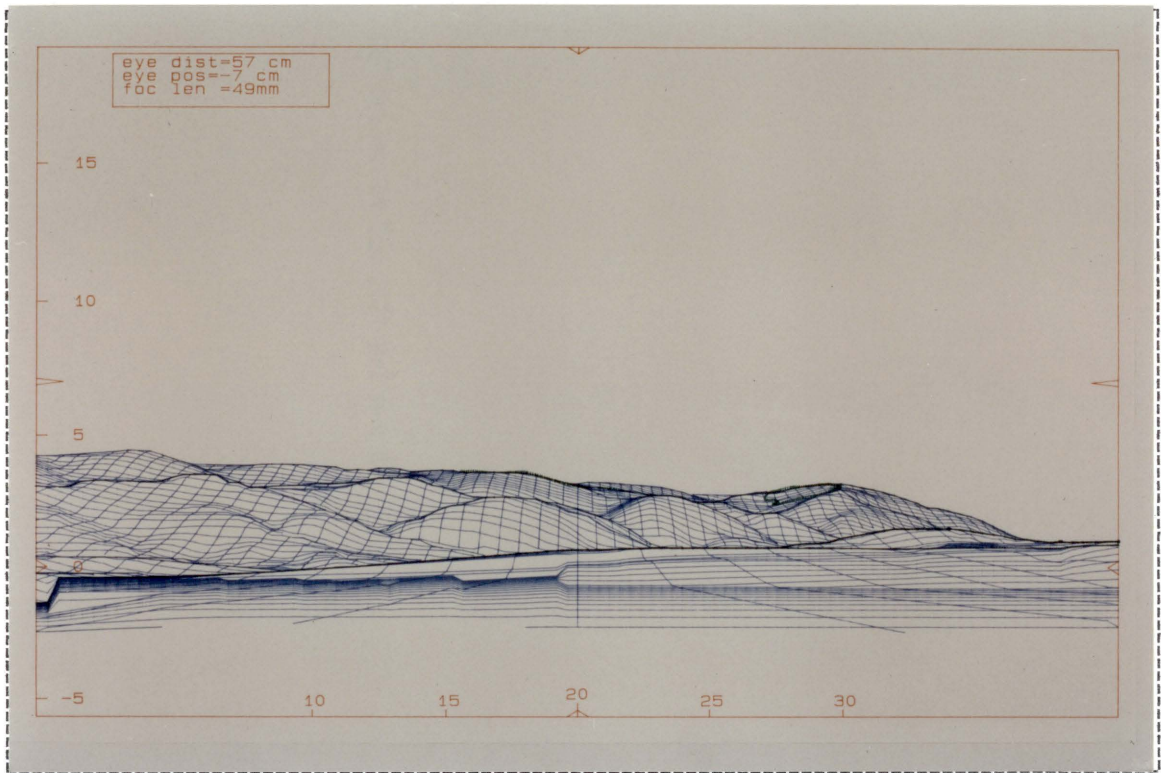
18 Radartower AZ 300 - PPlot



19 Radartower AZ 334 - PPlot



20 635 Intersection - Video Image



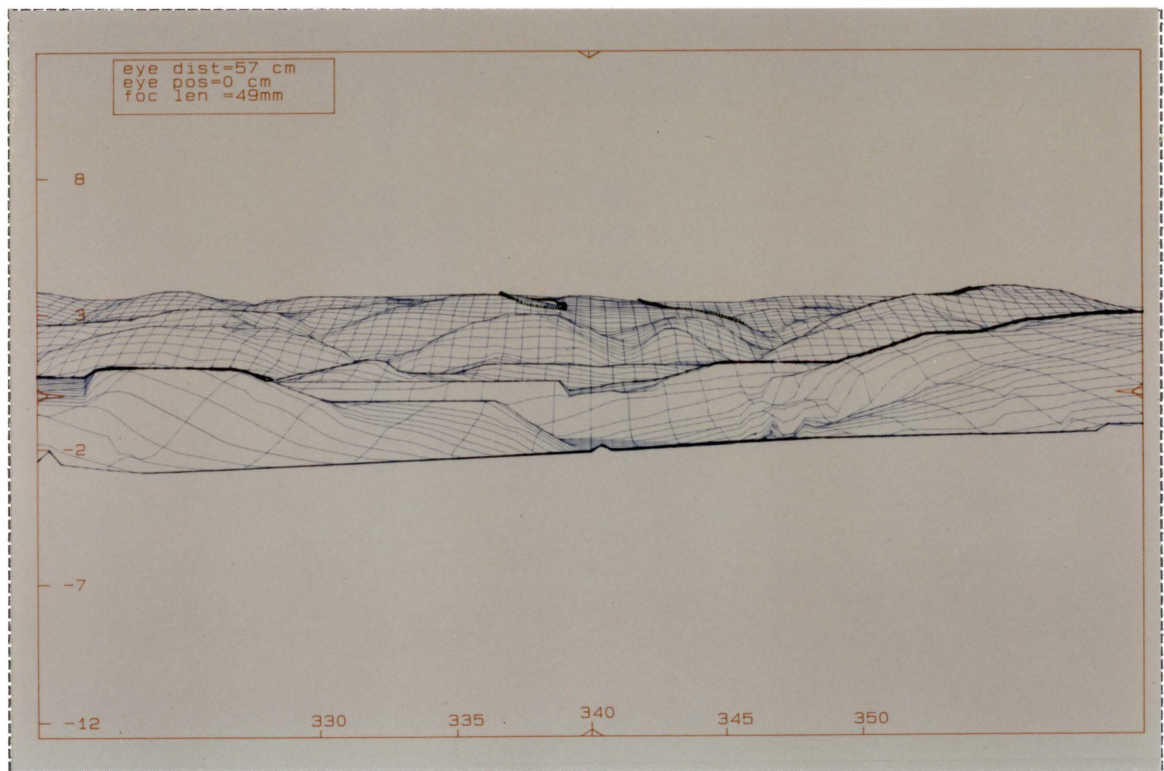
21 VA 100 Curve - PPlot cut



22 Ripplemead - Video cut



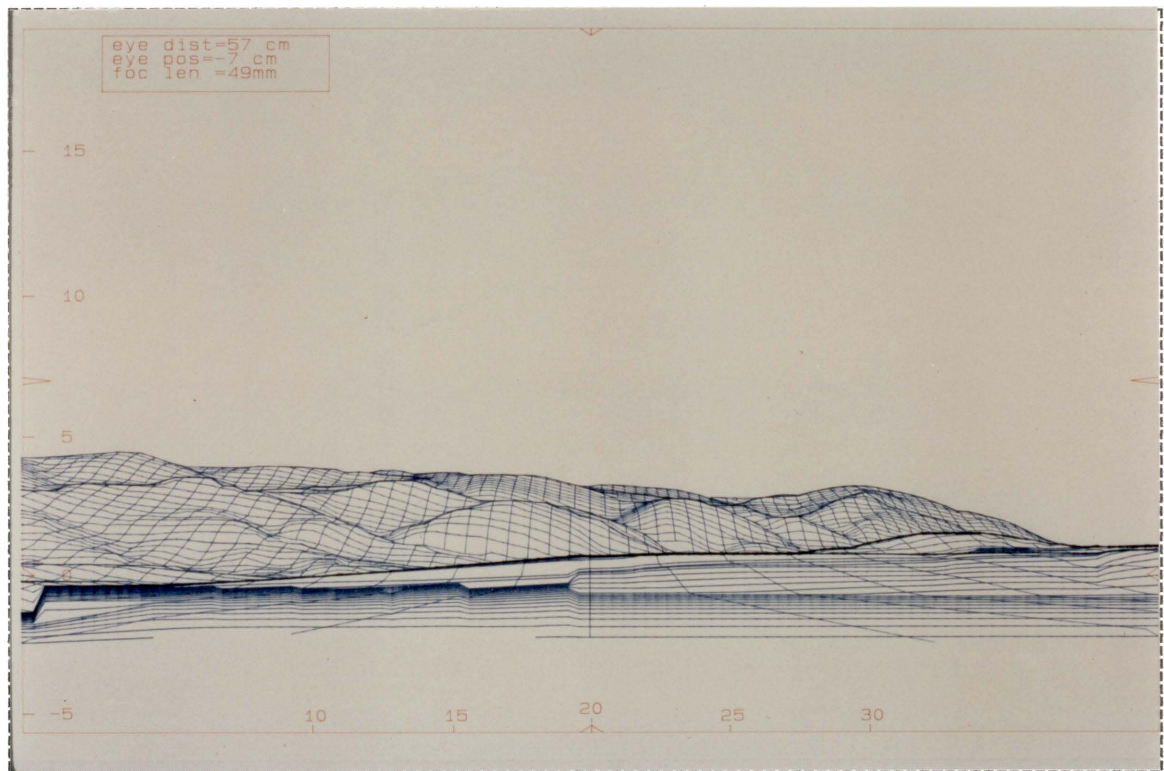
23 Radartower AZ 334 - Original Slide



24 Bridge - PPlot cut



25 Radartower AZ 300 - Video Image



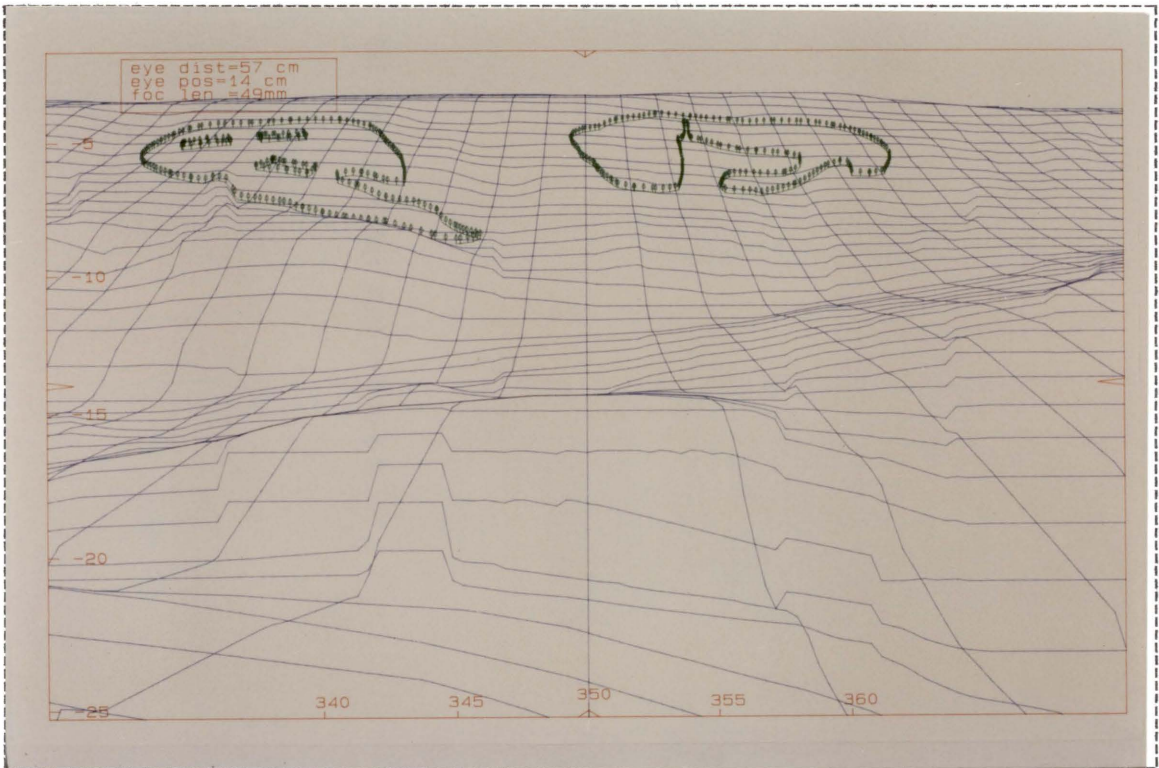
26 VA 100 Curve - PPlot



27 Ripplemead - Video Image



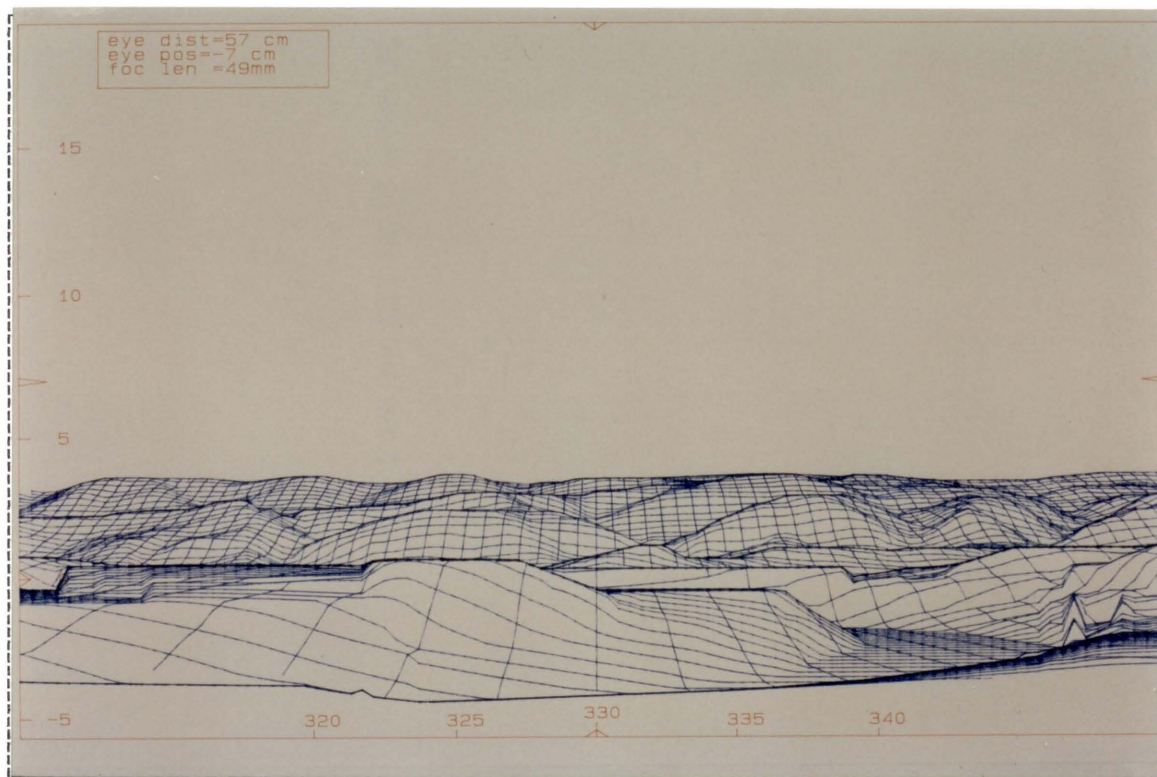
28 Radartower AZ 350 - Original Slide



29 Radartower AZ 350 - PPlot cut



30 635 Intersection - Original Slide

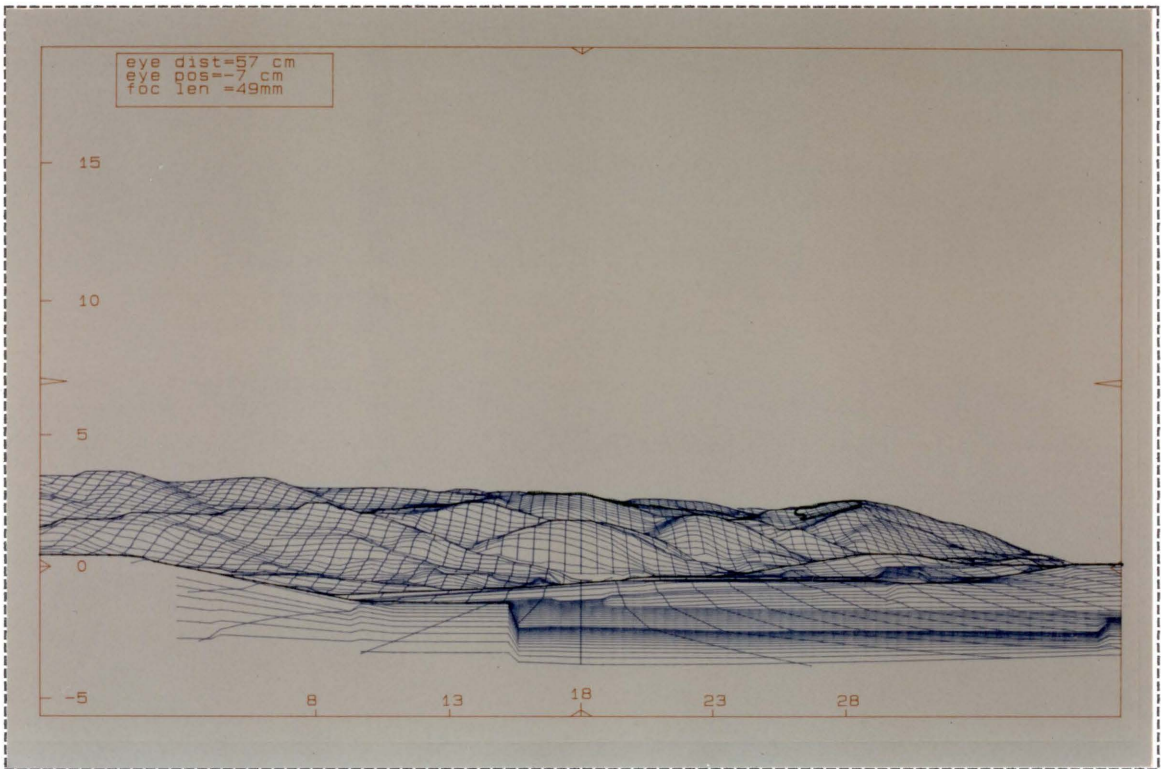


Preference Example

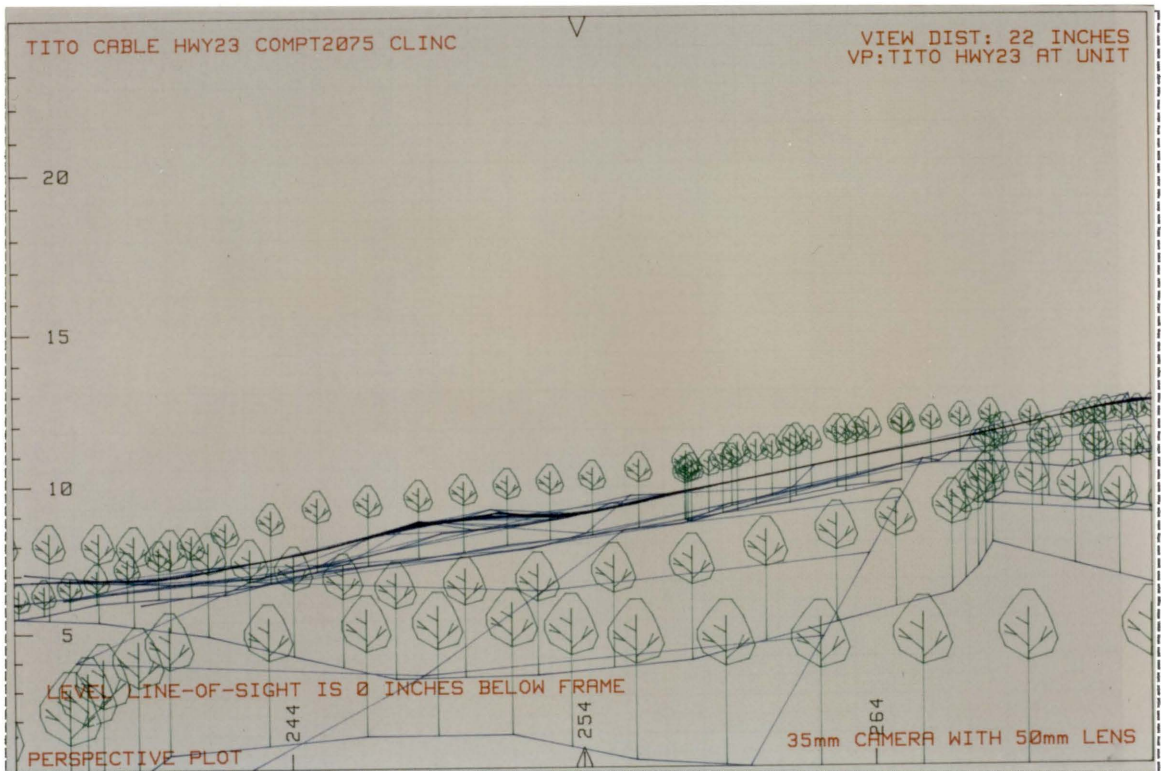


Preference Example

**ACCEPTABILITY TEST
IMAGES**



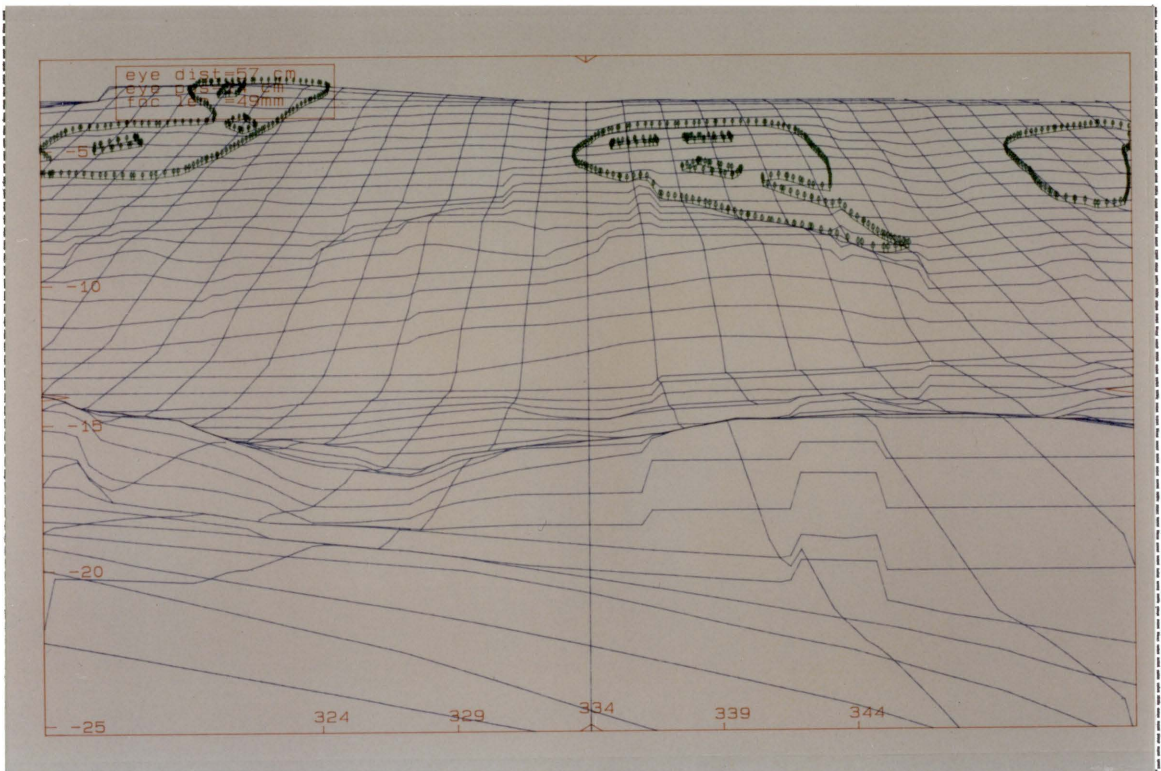
1 VA 100 Median - PPlot cut



2 Tito at Hwy 23 AZ 254 - PPlot cut



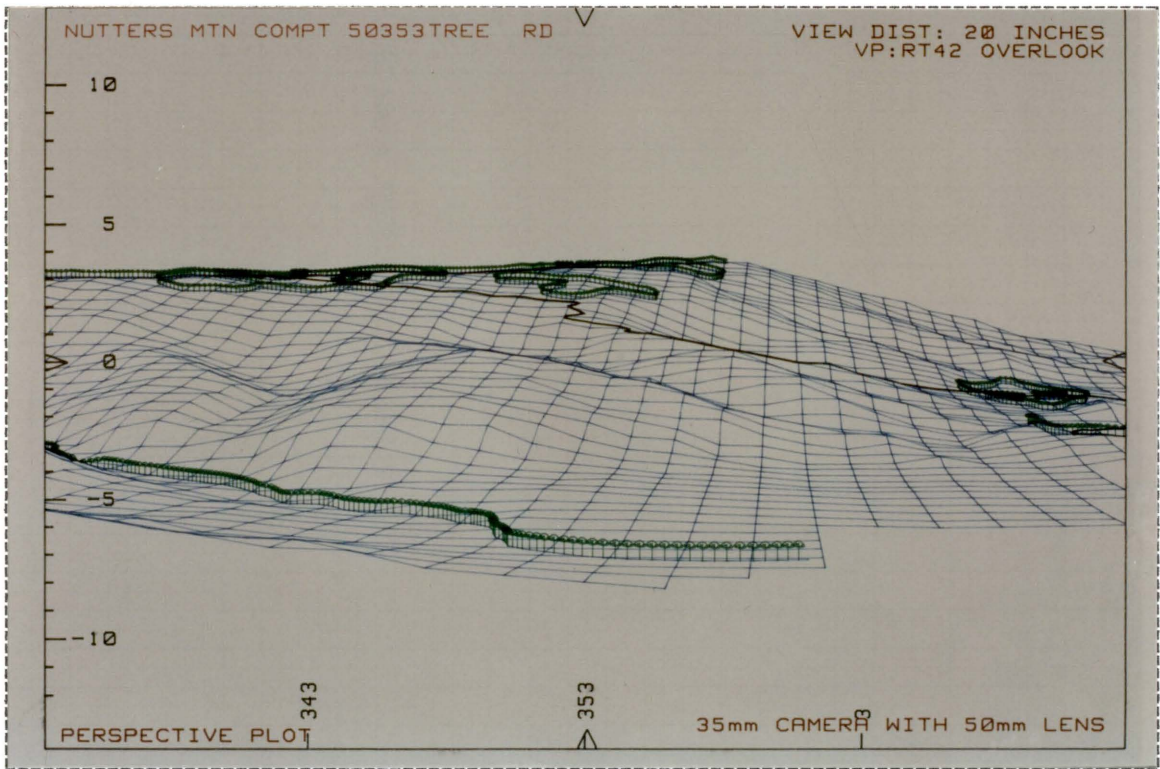
3 Radartower AZ 300 - Video cut



4 Radartower AZ 334 - PPlot cut



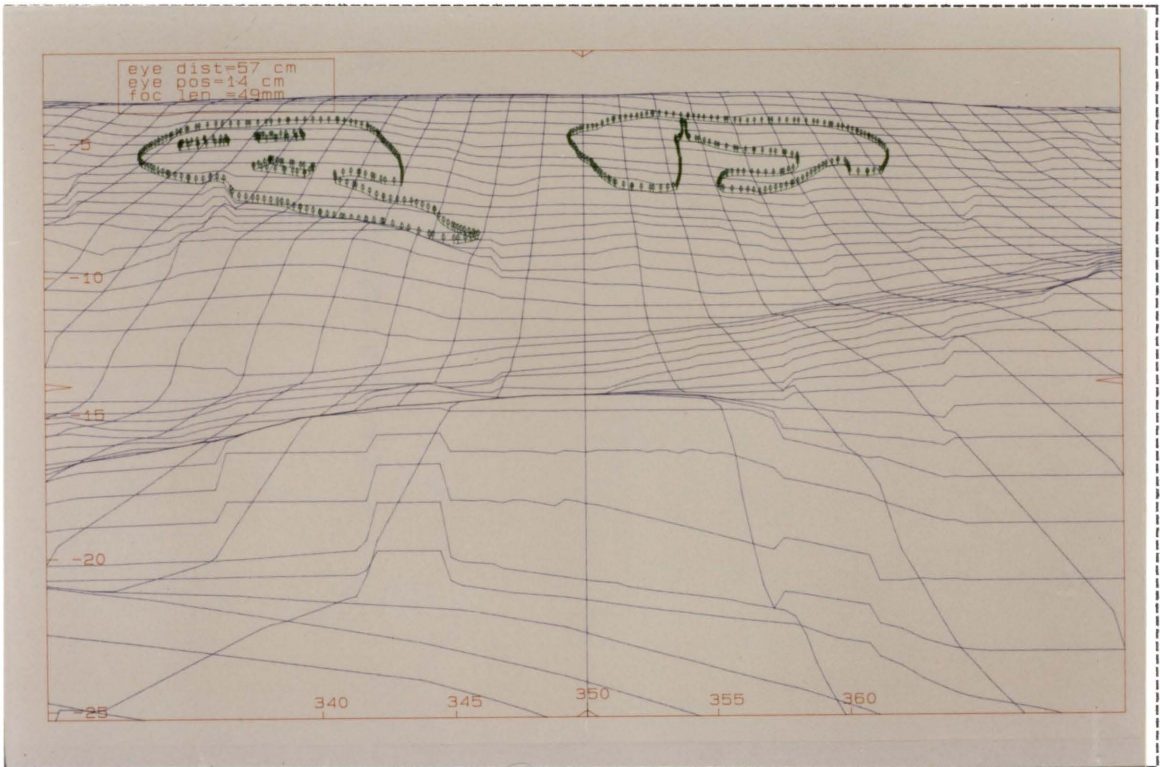
5 VA 100 Median - Video Cut



6 Nutter's Mountain - PPlot cut



7 Tito Hwy 23 at unit - Original Slide 50mm



8 Radartower AZ 350 - PPlot cut



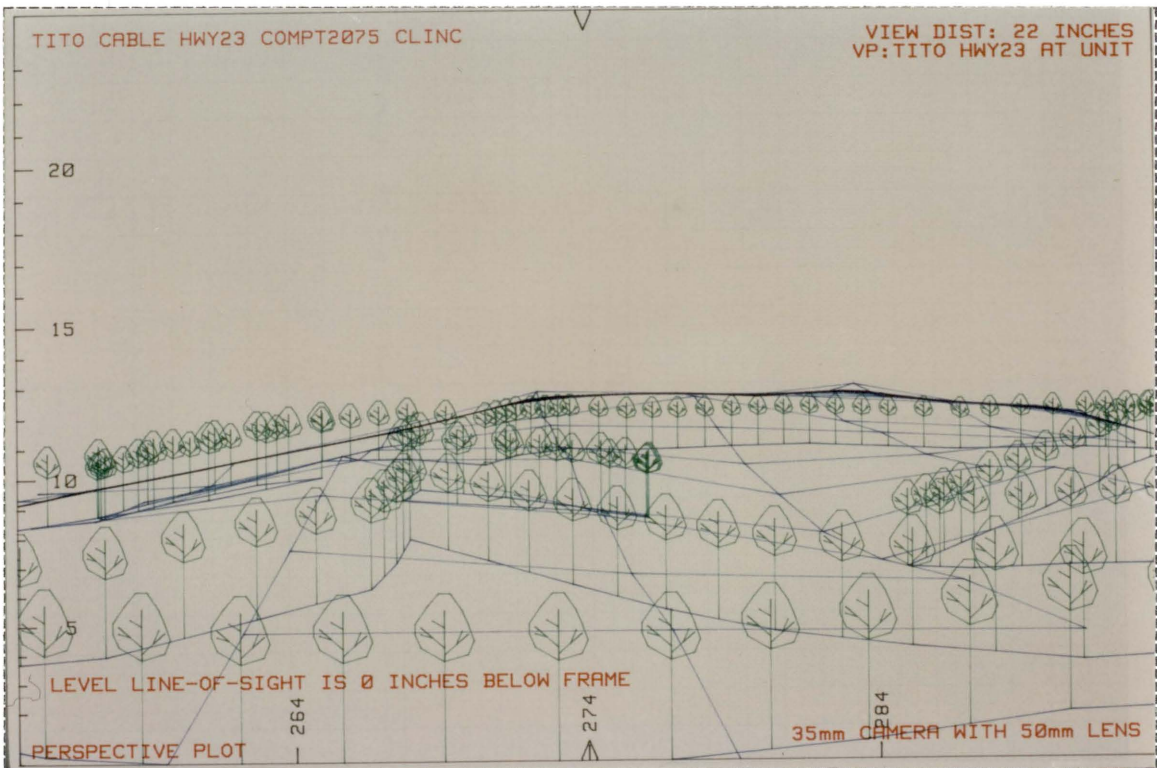
9 VA 100 Curve - Video cut



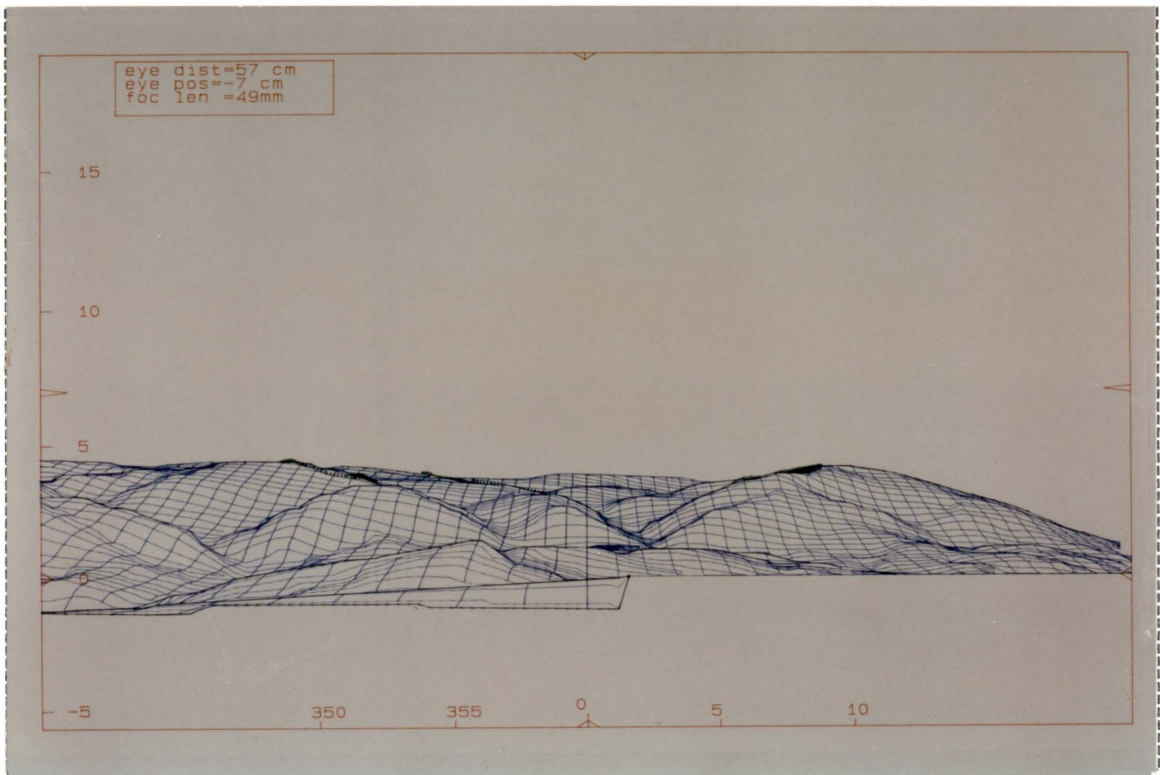
10 Rt. 42 overlook at New Castle, VA - Original Slide 24mm



11 Ripplemead - Video cut



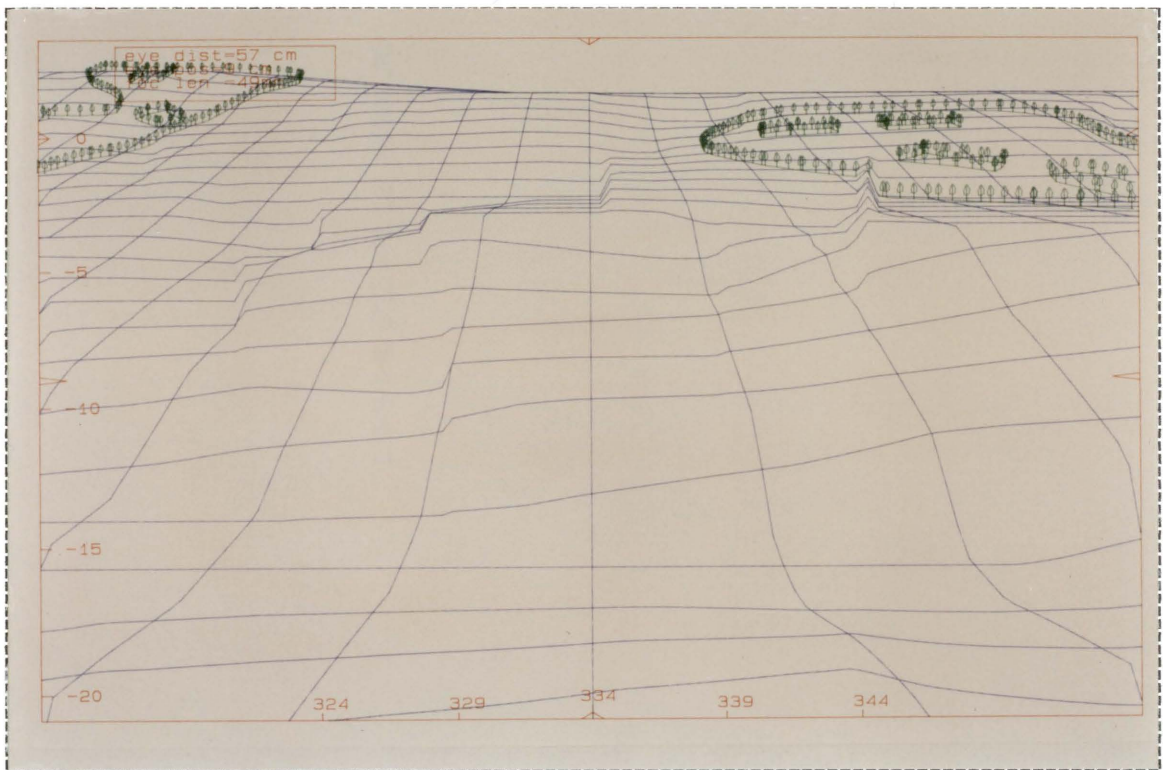
12 Tito at Hwy 23 50mm - PPlot cut



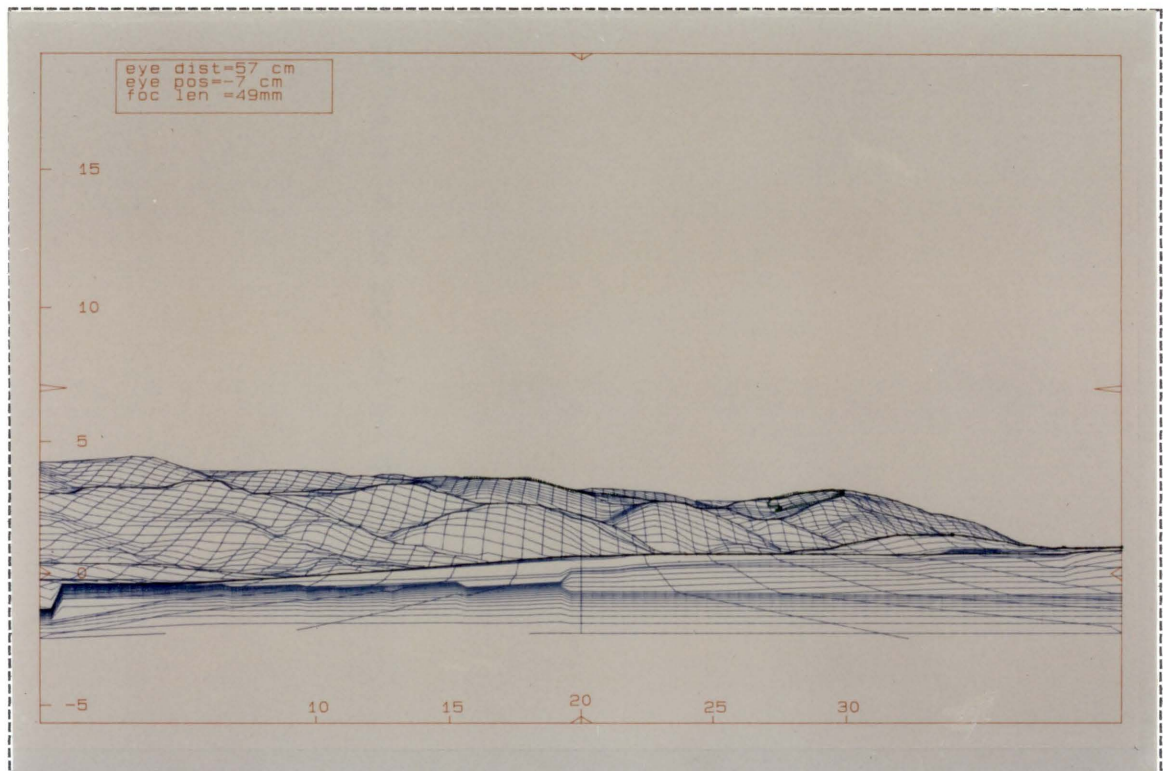
13 Ripplemead - PPlot cut



14 Radartower AZ 350 - Video cut



15 Appalachian Trail - PPlot cut



16 VA 100 Curve - PPlot cut



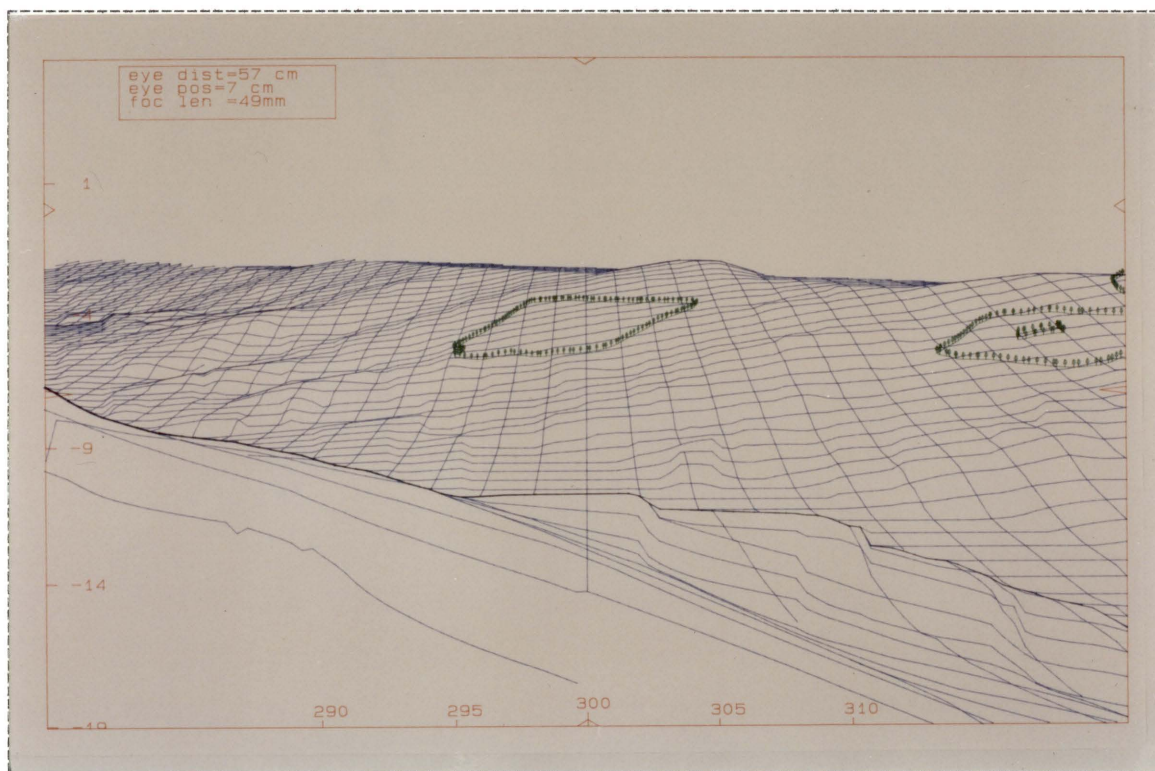
17 Tito Hwy 23 at unit - Original Slide 24mm



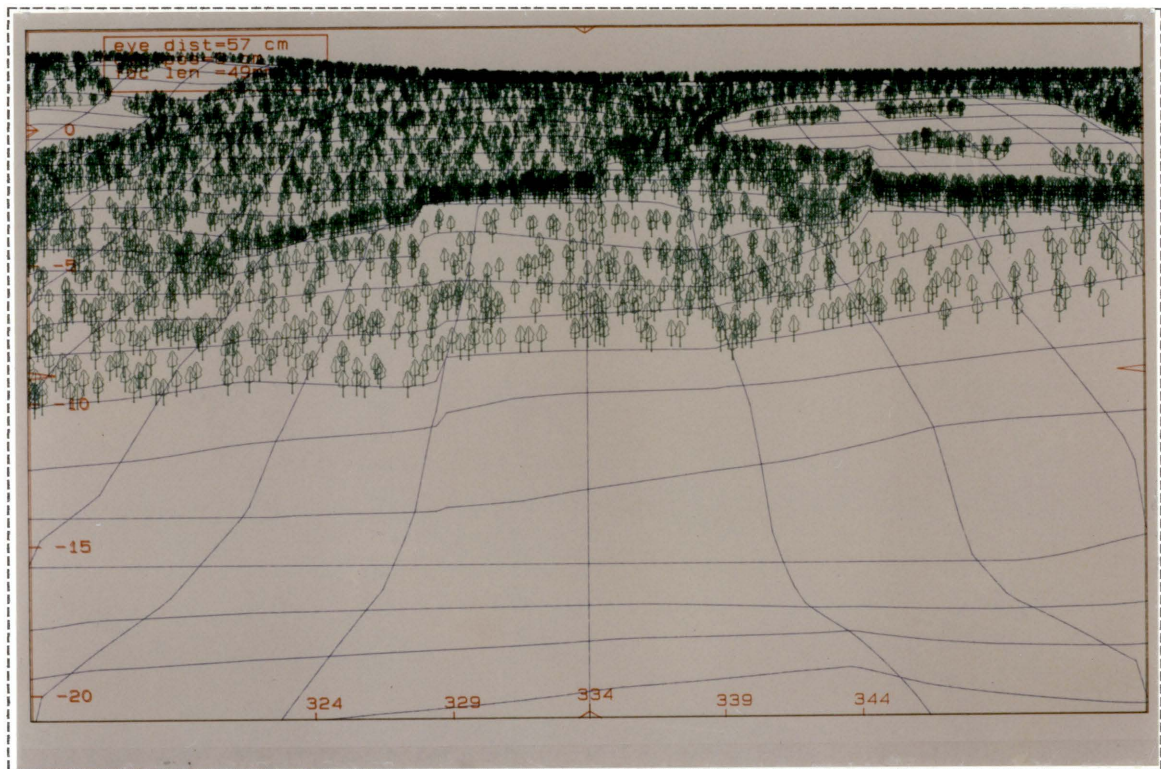
18 Radartower AZ 334 - Video cut



19 635 Intersection - Video cut



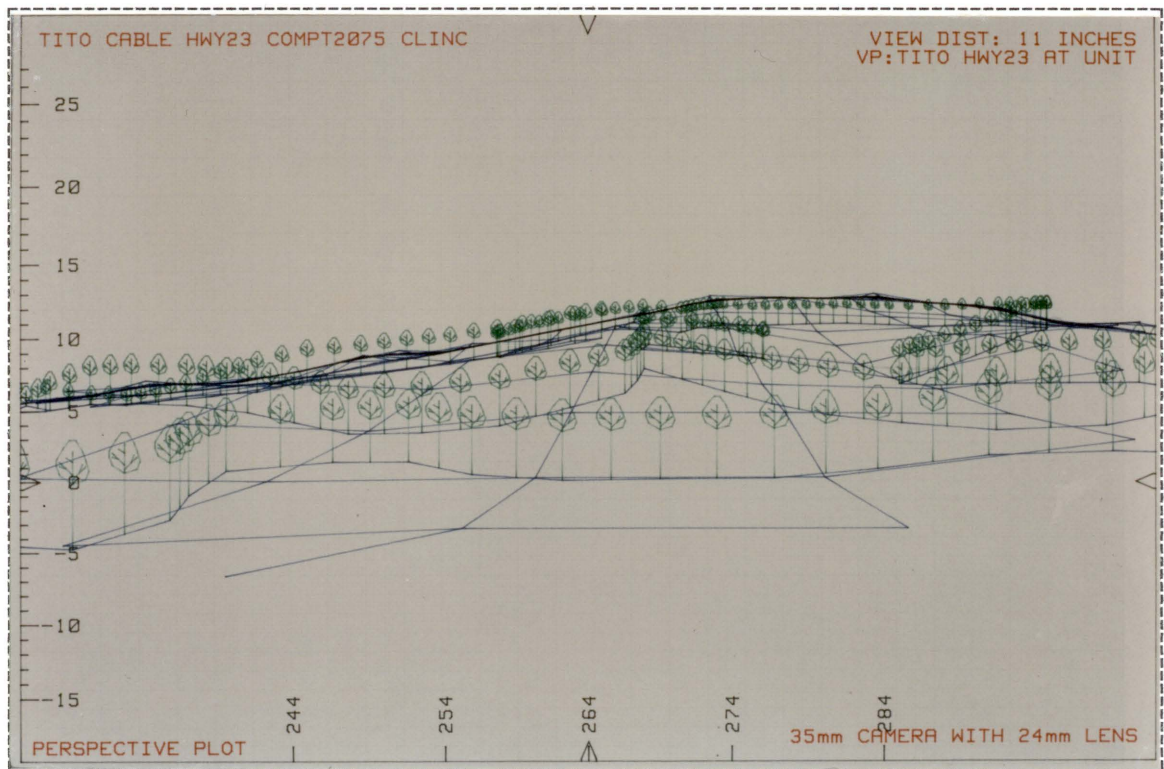
20 Radartower AZ 300 - PPlot cut



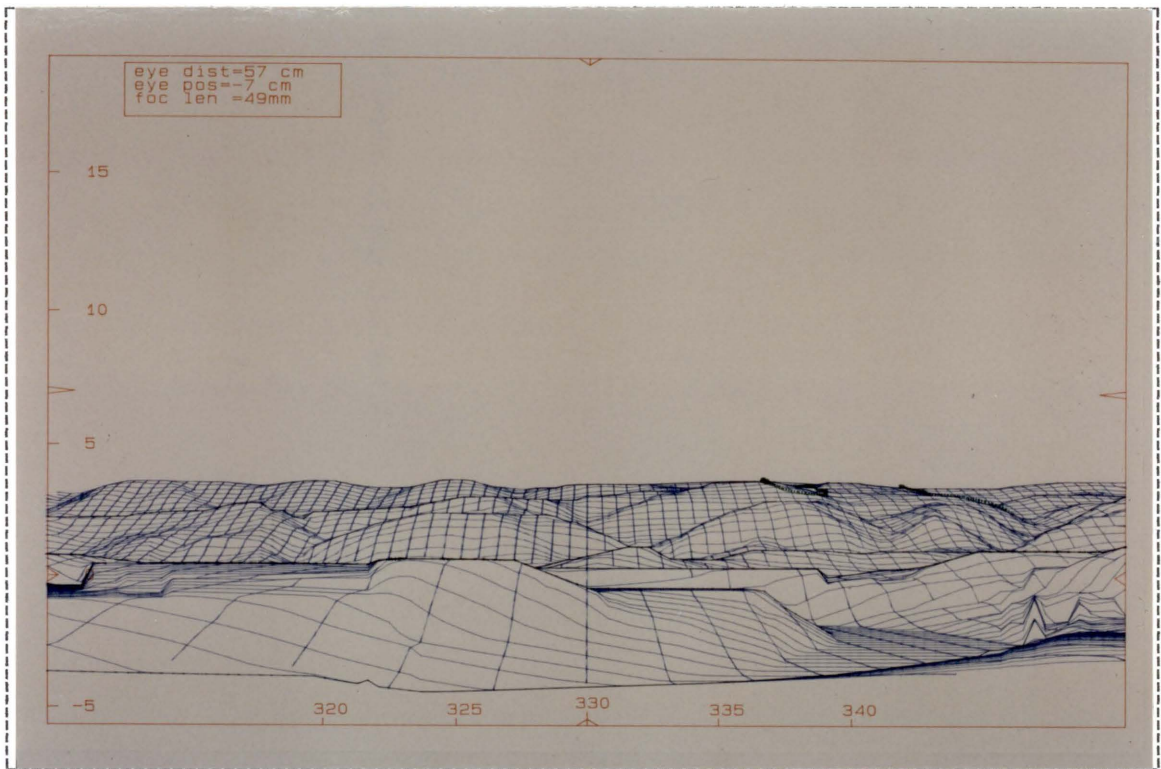
21 Appalachian Trail - PPlot cut with cover



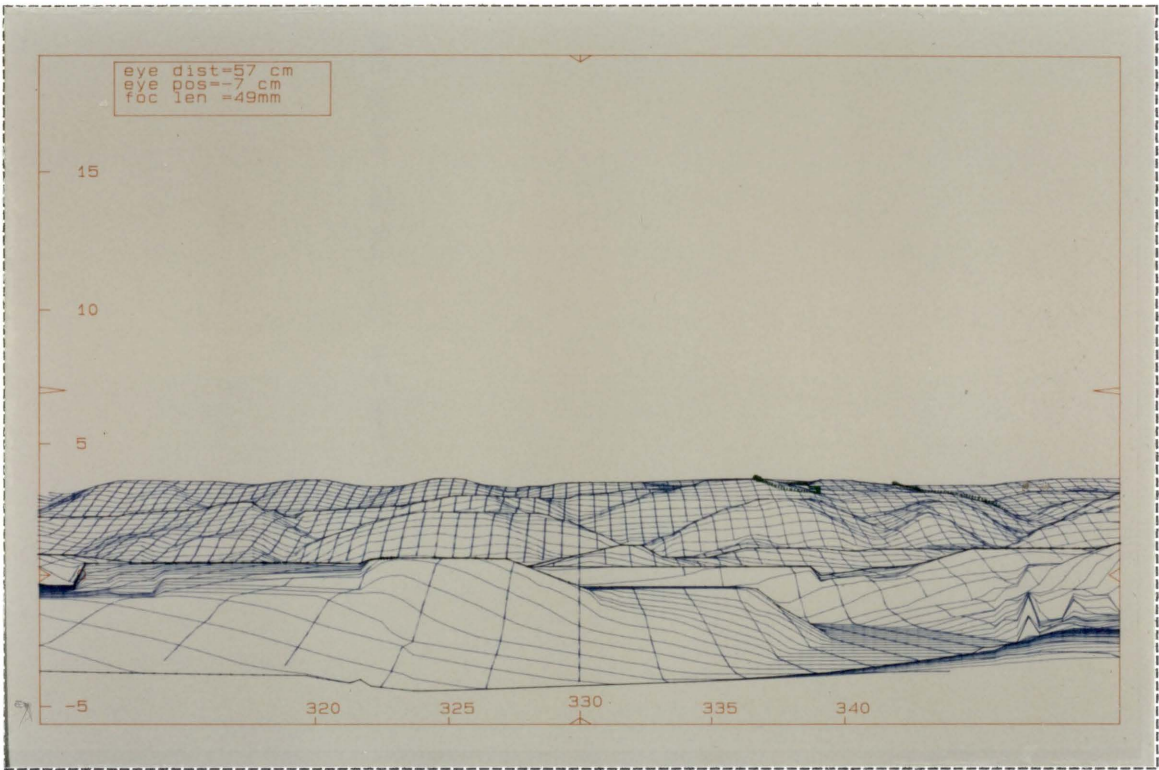
22 Tito Hwy 23 at unit AZ 254 - Original Slide



23 Tito at Hwy 23 24mm - PPlot cut



24 Bridge - PPlot cut



Acceptability Example



Acceptability Example

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