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Visual Assessment of Rivers and Marshes: An Examination of the Relationship of Visual Units, Perceptual Variables and Preference

John C. Ellsworth
Utah State University

VISUAL ASSESSMENT OF RIVERS AND MARSHES: AN EXAMINATION OF THE RELATIONSHIP OF VISUAL UNITS, PERCEPTUAL VARIABLES AND PREFERENCE

by

John C. Ellsworth

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of the requirements for the degree

of

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For Mom and Dad

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John C. Ellsworth

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ABSTRACT

Visual Assessment of Rivers and Marshes: An Examination of

the Relationship of Visual Units, Perceptual

Variables, and Preference

by

John C. Ellsworth, Master of Landscape Architecture

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Major Professor: Craig W. Johnson
Department: Landscape Architecture and Environmental Planning

The purpose of this research was to examine the relationship of two approaches to visual assessment of landscape--the qualitative descriptive inventory and the theoretically-based empirical perceptual preference approach. Three levels of landscape visual units based on bio-physical similarities (landscape units, setting units, and waterscape units) were identified in a marsh (Cutler Reservoir, Cache County, Utah), and its tributary streams. Color slide photographs were taken from five of the visual units. These slides were rated on a 5-point scale by panels of judges for the expression of four perceptual variables--coherence, complexity, mystery, and legibility. The same slides were rated on a 5-point scale by 98 respondents according to their preference for each slide. The relationship of the visual units, perceptual variables, and preference was evaluated by analytical and statistical procedures.

Results showed significant differences in the expression of the four perceptual variables between rivers and marshes and between setting

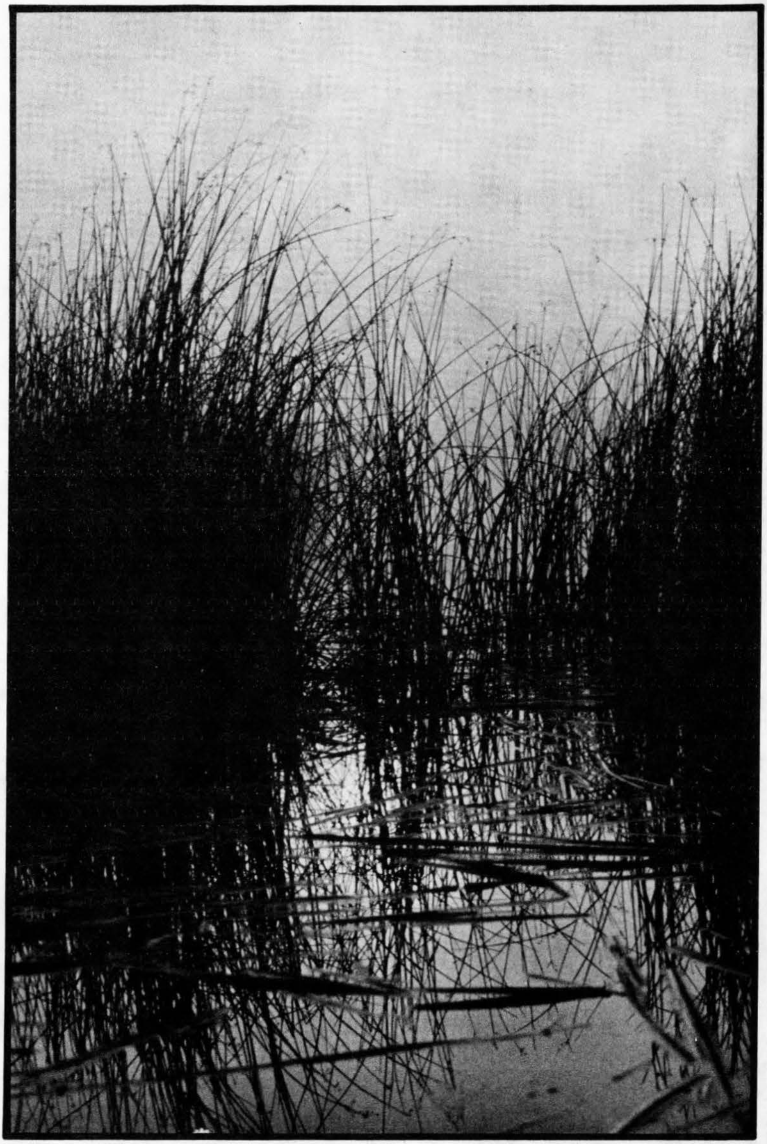
units. Both rivers and marshes were considered coherent when there were similarities in vegetation within the respective types; however, the strong horizontal organization of the marsh scenes necessary for coherence contrasted with the edge definition and orderliness considered necessary in rivers. Mystery was also related to similar factors in rivers and marshes (such as obscuring vegetation, particularly in the marsh) but the presence of riverbanks and bends in the river corridor had a distinct effect on mystery ratings in the river scenes. Complexity in both rivers and marshes was primarily dependent on diversity of vegetation and visual depth, but the number of different visual elements in river scenes also influenced complexity. Legibility was related to straight, enclosed and simple corridors in river images and to simple spaces with regular vegetation in marsh images. Fine textures and clear spatial definition enhanced legibility.

Preference ratings were significantly different between rivers and marshes, but not between river setting units or waterscape units. River scenes received higher preference ratings than marsh scenes. Mystery, complexity, and visual depth were especially important to preference. Demographic variables of age, sex, academic major, and home state did not significantly affect preference. Statistical analysis indicated each perceptual variable was an independent predictor, and that compared to visual units, perceptual variables were more strongly related to preference.

(172 pages)

I have seen these marshes
a thousand times,
yet each time
they're new.

Robert M. Pirsig



CHAPTER I

INTRODUCTION

Background

Visual assessment may be defined as an interdisciplinary effort to describe, inventory, and evaluate the visual characteristics of natural and man-affected landscapes in terms of physical features and human perceptions. The disciplines directly involved in visual assessment research and application include sociology, psychology, geography, geology, hydrology, engineering, economics, forestry, and landscape architecture (Litton, 1978). In addition, Appleton points to the work of many others as touching marginally on the subject--conservationists, architects, art historians, journalists, naturalists, novelists, and poets. The central question that concerns all of these diverse groups is a simple one--What is it that we like about landscape, and why do we like it? (Appleton, 1975). The answer to this question, as can be inferred from the diversity of disciplines and mass of research, is neither simple nor within the province of any one field of inquiry.

The state of the art in visual assessment has increased significantly in the last decade (Fabos and McGregor, 1979). In 1963 and 1964 there were notable studies by Lewis and by Zube and Dega that foretold the form and basic approach of many later studies (Lewis, 1963, 1964; Zube and Dega, 1964). The National Environmental Policy Act of 1970, the Forest and Rangeland Renewable Resources Planning Act of 1974, and the Federal Land Policy and Management Act of 1976 reflected the concern of the American public and government agencies for the scenic attributes of the public lands and legislated the recognition and management of those attributes (U.S. Congress, 1970, 1974, 1976). As a result, the Forest Service, U.S. Department of Agriculture, and the Bureau of Land Management, U.S. Department of the Interior, have developed complex systems for visual management of the public lands under their control (U.S.D.A. Forest Service, 1974; U.S.D.I. Bureau of Land Management, 1980). In 1976 the U.S. Forest Service published a bibliography dealing with "scenic beauty". It contained 167 papers, 95% of which dated from 1965 (Arthur and Boster, 1976). Since that time numerous similar works have been published, such that the researcher new to the study of visual assessment can be easily overwhelmed at the plethora of information available. In 1979 the U.S. Forest Service sponsored a conference at Incline Village, Nevada on analysis and management of the visual resource at which over 100 papers were presented and which resulted in the publishing of a 752 page proceedings (Elsner and Smardon (eds.), 1979). From this brief overview, the reader can begin to appreciate the history and significance of visual assessment, as well as the momentum with which research and application is being carried out across a diversity of disciplines.

Statement of the Problem

There are two basic categories of methodological approaches to visual assessment, as Anderson has thoroughly documented. They are (1) descriptive inventories and (2) perceptual preference studies (Anderson, 1978). The former may be considered the province of landscape architects and scientists, the latter the method of choice of environmental psychologists and other investigators of environment and behavior relationships. The focus of visual assessment in the last decade has paralleled the growth and pertinency of these two disciplines. Landscape architects and environmental psychologists have dedicated much time and creative effort to the study of the visual resource. Their professional viewpoints, the ways in which they define the visual resource, and the methods they use in both research and application are quite different.

Landscape architects approach the problem of visual assessment from a professional design-oriented position, relying on their training in aesthetic principles and their practical experience in landscape design to make the determination of what constitutes the visual resource, with the goal of the management of the resource for human use always in mind. As can be seen from a review of the literature in the next chapter, landscape architects (geologists, hydrologists, and geographers, as well), tend to define the visual resource in terms of the biophysical features of the environment (often grouped together in "visual units") and their professional aesthetic evaluation of those features or units (Litton, 1968; Tetlow and Sheppard, 1979; Leopold, 1969). The role of the observer is usually defined in terms of his physical position in the landscape (Litton, 1968; U.S.D.A. Forest Service, 1974) while his landscape preferences are believed to be associated directly with the biophysical features present in any particular landscape (Shafer, Hamilton, and Schmidt, 1969; Zube, Pitt, and Anderson, 1974).

Environmental psychologists and others concerned with human perception, while recognizing the importance of the physical landscape in defining the visual resource, place an equal if not greater emphasis on human perceptions, interpretations, and preferences in relation to landscape (Kaplan and Kaplan (eds.), 1978; Craik, 1972; Hammitt, 1978). They are more concerned with exploring the relationship between human behavior and environment and less concerned with developing specific management plans or objectives, although the implications of their theories and results of their research are at times incorporated in applied studies (Brown, Itami, and King, 1979). As discussed in detail in the next chapter, some environmental psychologists and others involved in perception research premise their investigations on the theory that there is a functional component of preference, one that is based in the evolutionary development of human beings as sophisticated information-processing organisms (Gibson, 1977; S. Kaplan, 1976). It has been the objective of much of this research to identify by empirical evidence the perceptual variables that support this theory and that can be used as predictors of preference for landscapes. Complexity was one of the earlier predictors identified; Kaplan and his colleagues have identified three other predictors which he terms coherence, legibility, and mystery (Wohlwill, 1968; S. Kaplan, 1979).

Appleton summarizes the two basic categories of methodological approaches in his engaging book, The Experience of Landscape.

> Although the task on which we have embarked touches on many disciplines, the ideas involved may, as we have seen, be grouped roughly into two categories, depending on whether they are concerned principally with the interpretation of the landscape or with our experience of it. In the former category we may include those attempts which have been made to explain the phenomena of our visible surroundings, how they originated and developed, how they are related to each other, how they differ individually and in association with each other from place to place. In the latter category our concern is with the observer, how he looks at his environment and how he seeks to explain the satisfaction which he derives from so doing. (Appleton, 1975, p. 24)

There has been a lack of investigation into the relationship of these two approaches, even though the importance of this relationship has been recognized and there have been repeated calls by professionals working with one or the other of the two approaches for such investigation (Zube, Pitt, and Anderson, 1975; Anderson, 1978; Litton, 1979; Lee, 1979; R. Kaplan, 1977a; S. Kaplan, 1981). Litton recognized the need for research in this area in his presentation to the Colorado chapter of the American Society of Landscape Architects in 1978.

> A basic problem in research is the need to better coordinate the present diversity of landscape studies. We need to make useful linkages between perceptual studies, for example, and those which address visual physical elements and relationships. (Litton, 1978, p. 6)

This, then, is the problem confronting those researchers and practitioners who recognize the respective utility and importance of these two approaches to visual assessment, but are faced with a vacuum of empirical evidence regarding their relationship. They are forced either to rely on intuition and best professional judgment when attempting to combine the two methods (a potentially dangerous and indefensible course of action), or to succumb to the lack of knowledge and employ only one approach, sacrificing the potential insights and advantages of the other.

Purpose of the Study

The intent of the research reported here is to investigate the relationship between descriptive inventory and perceptual preference approaches to visual assessment. In order to keep the research within manageable limits, it was necessary to isolate specific aspects of one subtype of each approach and employ color slide photographs of a specific study site as a research vehicle for investigating the relationship of the two approaches. The concept of visual units (specifically setting units and waterscape units) based on biophysical factors and derived by professional judgment (Litton, 1974) was chosen from the qualitative descriptive inventory approach to be related to observer preference and to the perceptual variables of coherence, complexity, mystery, and legibility chosen from the theoretically-based empirical perceptual preference approach (S. Kaplan, 1979). The study site chosen was Cutler Reservoir, the subject of a previous study in which rivers and marshes were the principle landscape types (Ellsworth, 1980). Along with the information generated from that study, the use of the Cutler Reservoir site in this project offers the added benefit of research into the visual characteristics of marshes, a landscape type for which the literature search revealed no previous visual assessments.

Given the nature of the problem and purpose of the study as presented thus far, research questions to be addressed can be summarized as follows:

I.A. What is the relative degree of expression of the perceptual variables of coherence, complexity, mystery, and legibility in riverscapes, marshscapes, setting units, and waterscape units?

I.B. Are there statistically significant differences in the degree of expression of the perceptual variables between the two landscape types (rivers and marshes), between setting units, or between waterscape units within the same setting unit?

II.A. What are the relative preferences people express for riverscapes, marshscapes, setting units, and waterscape units?

II.B. Are the differences in expressed preference mean ratings between landscape types, setting units, and waterscape units statistically significant?

II.C. Do demographic variables (age, sex, home state, and academic major) and viewing sequence have any statistically significant effect on preference at the setting unit or waterscape unit scale or over all the slides?

III.A. Are there significant correlations between pairs of perceptual variables (based on judges' ratings) or between individual perceptual variables and preference (based on mean preference as expressed by respondents) over all the slides or at the landscape type, setting unit, or waterscape unit scale; in other words, which perceptual variables are strongly related to preference and to one another?

III.B. Do perceptual variables or visual units explain a more significant amount of the variability in mean preference ratings; in other words, which of the two are more strongly related to preference?

Organization of the Document

Chapter Two, Review of the Literature, summarizes research and applications of both descriptive inventory and perceptual preference studies. Chapter Three details the methodologies chosen for implementing the approaches in the study site selected and summarizes the relevant findings of the 1980 Cutler Reservoir study. Chapter Four presents the data gathered, statistical procedures employed, and the results obtained. Chapter Five discusses the implications of the findings and suggests areas of further research. The previous study of Cutler Reservoir is included in Appendix E.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

The purpose of this chapter is to acquaint the reader with examples of research and application of the two approaches to visual assessment pertinent to this study, the descriptive inventory and the perceptual preference approach. Subtypes of each approach will be defined and relevant studies cited. Studies employing the qualitative descriptive inventory and theoretically-based empirical perceptual preference approach will be discussed in detail, particularly those dealing with water, and more specifically rivers and streams, in the natural environment.

The work of R. Burton Litton, Jr. will be reviewed extensively for four reasons: (1) Mr. Litton's method of landscape assessment was used in the Cutler Reservoir study (Ellsworth, 1980), data from which is integrated in the current study; (2) Mr. Litton's pioneering work has had pervasive and significant influence on a great number of qualitative descriptive inventories; (3) his method is based on accepted aesthetic principles; and (4) his method assigns prominence and importance to the concept of visual units, a major research variable in the present study.

The research of Rachel Kaplan and Stephen Kaplan will be reviewed as exemplary of the theoretically-based empirical perceptual preference approach. There are three reasons for this focus, fundamentally similar to those stated above: (1) the Kaplans' research has been influential on other perceptual preference studies; (2) their methods are founded in a well-articulated and cross-disciplinary theoretical underpinning; and (3) the perceptual variables of coherence, complexity, mystery, and legibility, formulated from and based on ample empirical evidence and central to the Kaplans' theoretical framework, have been selected as major research variables in this study.

Descriptive Inventories

There are two types of descriptive inventories commonly used in visual assessment--quantitative and qualitative (Anderson, 1978). The quantitative descriptive inventory approach is based on the premise that the biophysical and cultural aspects of a landscape can be objectively inventoried, counted, and measured. These features are then used to define the visual resources of the study area. One of the first studies using this approach on rivers was done by Leopold (1969); Smardon applied the method to inland wetlands in Massachussetts (1975).

Qualitative descriptive inventories. The qualitative descriptive inventory approach is similar to the quantitative approach in that the biophysical and cultural features of the landscape are inventoried and described. However, instead of counting or measuring these features according to accepted scientific or similar objective procedures, the qualitative approach frequently groups them into landscape character types or visual units based on biophysical consistencies and similarities (Litton, et al., 1974; U.S.D.A. Forest Service, 1974; Litton and Shiozawa, 1971; Tetlow and Sheppard, 1979). These groupings are then analyzed and evaluated by professionals, most frequently landscape architects, in terms of aesthetic or design principles (Litton, 1968; 1972), suitability for achieving specific visual management classes or objectives such as preservation, modification, or rehabilitation (U.S.D.A. Forest Service, 1974; U.S.D.I. Bureau of Land Management, 1980) or as to their ability to accept or absorb man-induced visual change (Litton, 1974; Anderson, Mosier, and Chandler, 1979).

One of the first and most influential methods of qualitative descriptive inventories was Litton's "Forest Landscape Description and Inventories--a basis for land planning and design" (1968). He approaches the research from a designer's perspective.

> Calling the landscape a scenic resource assumes that it has esthetic value...it follows that the discipline of design can provide a particular point of view as to what constitutes the landscape, what affects visual perception of it, and how it may be categorized. (Litton, 1968, p. 2)

From this perspective, he outlines six variable factors that affect the landscape or the observer. He terms these "factors of scenic analysis and observation." Three are concerned essentially with the landscape--form, spatial definition, and light. Distance, observer position, and sequence deal with the observer of the landscape and his physical and temporal relationship to it. He then elaborates on each of these factors in some detail, for example describing distance in terms of foreground, middleground, and background and observer position in terms of inferior, normal, or superior in his physical relationship to the landscape being viewed.

In order to provide a visual framework for observation, Litton recognizes seven landscape "compositional types". He sees four of these as being fundamental and of larger scale--panoramic, feature, enclosed, and focal landscapes; while the remaining three he terms secondary, of smaller scale, and potentially transitory in nature--undergrowth, detail, and ephemeral landscapes. He then illustrates the use of these concepts in two landscape inventories of the visual corridors of State and U.S. highways.

Litton refines these concepts and discusses evaluation criteria and management goals in a later article (1972). He writes of "factors of recognition" as being form, space, and time variability (primary factors) and observer position, distance, and sequence (secondary factors). Under "compositional types" he adds one--forest (canopied), and omits two of the previous types--undergrowth and ephemeral. The basic concepts remain the same despite the shifts in nomenclature. Similarly, he reviews two types of landscape inventories, route-based and area.

In this work Litton defines the three aesthetic criteria for landscape evaluation that he considers important and that become major influences on much of his later work.

> Unity is that quality of wholeness in which all parts cohere, not merely as an assembly but as a single harmonious unit...Vividness is that quality in the landscape which gives distinction and makes it visually striking...Variety, in simple form, can be defined as an index to how many different objects and relationships are found present in a landscape. (Litton, 1972, pp. 284-286)

He suggests applying these criteria and their elaboration as expressed in the recognition factors in order to make aesthetic evaluations of landscape, for instance by making comparisons among examples of the same kinds of landscape types. Finally, he outlines potentially valid visual resource management goals. These include preservation, protection and maintenance, enhancement, degradation (a negative change rather than a goal), rehabilitation, restoration, and remodeling.

Litton's concepts in these two papers permeate the Visual Management Systems developed by the U.S.D.A. Forest Service (1974) and the U.S.D.I. Bureau of Land Management (1980). The Forest Service system relies on basic premises to develop "variety classes" and "sensitivity levels" which are combined to suggest "visual quality objectives". The 15 basic premises can be summarized in three statements:

(1) Landscapes with the greatest variety have the greatest potential for high scenic value.

(2) The aesthetic concerns and physical/temporal relationships of viewers to the landscape are important.

(3) Landscape "character" and visual susceptibility to management impacts are critical concerns.

The three variety classes are based on the degree of variety in the landscape as expressed in physical features and evaluated by the amount of form, line, color, and texture (concepts borrowed from the design professions) exhibited. Charts and maps are developed to communicate the description and locations of the variety classes on National Forest Lands. Sensitivity Levels are defined as a measure of people's concern for scenic quality and are partitioned into three levels based on whether lands are viewed from primary or secondary travel routes, use areas, or water bodies and on the degree of visitor concern for scenic quality. This degree of concern is determined in most cases by the professional judgment of the land managers or by interviewing selected individuals representing specific interest groups (Stalder, 1982). Maps are prepared to illustrate these levels and the viewing distance is addressed by delineating foreground, middleground, and background, concepts directly related to Litton's earlier work (1968). Visual quality objectives are enumerated and their appropriateness derived by combining variety classes and sensitivity levels in a two by two matrix. These objectives are considered long-term (preservation, retention, partial retention, modification, maximum modification) and short-term (rehabilitation, enhancement). Again, the direct link to Litton's earlier work (1972) is obvious.

The Forest Service has expanded their visual management system into two volumes and five chapters to meet the visual resource management needs involved in utility corridor location, range management, roads, and timber harvesting (U.S.D.A. Forest Service, 1973; 1974; 1975; 1977a; 1977b; 1980). The Visual Resource Management Program of the Bureau of Land Management is very similar to the Forest Service Visual Management System and will therefore not be reviewed.

The concept of visual units as the primary tool in serving the objective of maintaining or achieving unity in the landscape is described by Litton, et al. in the book Water and Landscape: An Aesthetic Overview of the Role of Water in the Landscape (1974). Three levels of visual units, distinguished primarily by scale, are suggested. They are the landscape unit, the setting unit, and the waterscape unit.

Features considered important to the landscape unit include boundary definition, general form-terrain pattern, features, vegetation patterns, water presence, weather, and cultural/land use patterns. The requirements for the presence and expression of water in this unit are clearly stated.

> This unit necessarily contains a series of characteristic streams or water bodies as an essential part, providing a special differentiation from setting and waterscape units in which a single stream, or a single lake or connected lakes are typical. (Litton, et al., 1974, p. 23)

The setting unit is delineated by landscape expression such as landform, vegetation patterns, and human impacts and by water expression described by prominence, continuity, transition and human impacts. The smaller scale and enhanced role of water is apparent.

> Water as a stream or lake--or visually linked lakes--is assumed to be a central element within the unit. Included water elements may be visually strong or weak. (Litton, et al., 1974, p. 43)

Factors important in the waterscape unit include the water element (spatial expression and edge, appearance, evidence of human impact, etc.) and the shore element (edge definition, spatial expression, riparian environment, evidence of human impact, etc.). In this unit, the small scale accentuates the water as the primary visual element.

> Visual dominance of a waterbody or unified segments of it occur as parts stand out in contrast to the parent body. The nature of water in contrast to land as a solid is the source of its visual dominance, yet it can be true that the shore, because of area and expanse, may well transcend the area or expanse of water present. (Litton, et al., 1974, p. 75)

The authors utilize the visual unit designations for evaluating water dominated landscapes according to the aesthetic criteria of unity, variety, and vividness and in making high-low quality comparisons between selected examples of units. They set down guidelines for the classification of man-made elements and improvements related to each of the three units. Finally, they make policy, planning, and research recommendations concerned with the aesthetic and environmental role of water in the landscape.

Litton and others have further refined and defined the attributes of visual units and suggested more diverse applications. The assessment of river quality in particular is outlined in the proceedings of a national river recreation symposium (Litton, 1977). Ellsworth used the concepts of landscape, setting and waterscape units in an inventory of the visual resources of a reservoir and its tributary streams in Utah (1980). The northern great plains states of Montana, Colorado, North Dakota, and South Dakota were the subject of a scenic analysis in which two visual units of even larger scale, the landscape continuity and landscape province, were envisioned (Litton and Tetlow, 1978). In 1979 at Incline Village, Nevada, Tetlow and Sheppard described the use of visual units for mapping and analysis and for comparing visual attributes between units (1979), while Litton presented a paper summarizing the descriptive inventory approach to landscape analysis (1979).

Perceptual Preference Approaches

The three types of perceptual preference approaches used in visual assessment are the expert generated, empirical, and theoretically-based empirical (Anderson, 1978). While each of these recognizes the relationship between the landscape and the observer as being the basis for visual values, they differ markedly in their basic premises.

Anderson describes the expert-generated approach.

> Expert generated perceptual studies are those in which the investigator decides which features in the landscape environment are important to visual resource values and quality. These features are subjected to ratings, usually by trained observers, to arrive at scales, indices, or other determinations of resource or scenic values. This latter process which often involves factor analytic procedures provides an empirical basis for these studies although the investigator preselects the variables to be tested. (Anderson, 1978, pp. 21-22)

He reviews representative studies using this approach, including Sargent (1966) and Shafer and Mietz (1970).

He makes the distinction between expert-generated and empirical studies.

> These, like the expert-generated studies, make extensive use of observer reactions to visual landscape features. A major difference between the two lies in the orientation that group evaluations of visual resource values should be derived from statistical (empirical) procedures such as factor analysis rather than constructed on a priori grounds by a theorist or expert. (Anderson, 1978, p. 24)

Notable examples of this type of approach include the Scenic Beauty Estimation Method developed by Daniel and Boster (1976) and a study done on the southern Connecticut River Valley (Zube, Pitt, and Anderson, 1974).

Theoretically-based empirical approach. The theoretically-based empirical approach has been used extensively across a range of visual assessment studies in recent years (R. Kaplan, 1977; S. Kaplan and Wendt, 1972; Hammitt, 1978; Gallagher, 1977; Lee, 1979). This approach is couched in a theoretical underpinning that distinguishes it from the expert-generated and empirical studies.

> The rationale for this approach is based on a conception of human behavior, in particular, on cognitive and perceptual theories. These concepts involve a point of view of how people receive and integrate information about the environment and how this information affects their behavior. (Anderson, 1978, pp. 30-31)

The work of Rachel Kaplan, Stephen Kaplan and their colleagues is well-documented and the underlying theory is understandable, reasonable, and multi-disciplinary. This theory, its implications, and research conducted by Kaplans and others will be reviewed in this section.

The evolution of the Kaplans' theory and framework for applying that theory to landscape preference assessment can be traced in the published literature. The importance of understanding the evolutionary development of humans as complex information-processing organisms that required cognitive survival skills under unfavorable conditions is outlined in a paper by Stephen Kaplan (1972). The important processes that the individual must possess relevant to these skills are postulated.

> (a) He must know where he is. (b) He must know what might happen next. (c) He must know whether these next things are good or bad. And (d) he must know what to do. Through these processes (perhaps more familiar as perception, prediction, evaluation, and action), man structures his uncertain environment and makes it livable. (S. Kaplan, 1972, p. 141)

Also in 1972, S. Kaplan and J.S. Wendt presented a paper to the Environmental Design Research Association conference in Los Angeles. The research reported found nature scenes to be preferred over urban scenes and complexity to be a predictor of preference for each domain but <u>not</u> to account for preference of nature over urban. Factors of evolutionary significance to the prediction of preference are termed "primary landscape qualities" and include water, paths, and nature in general. But the most significant portion of this paper is the proposed theoretical framework based on Kaplan's informational approach to environmental preference. It groups the components complexity and mystery in a "predicted information" dimension and the components identifiability and coherence in a "legibility" dimension. These concepts will be discussed thoroughly in a moment, but for now the initial <u>structure</u> of the framework is more important for understanding the development of the theory. The dimensions of texture and spaciousness are included as potential components of the framework alongside coherence and identifiability respectively in "An Informal Model for the Prediction of Preference" (S. Kaplan, 1975). The theoretical framework remains essentially the same. Much of the paper summarizes the research and theory leading up to the development of the framework as presented.

Two articles published in 1973 explore the concepts more fully and extend the theoretical basis in light of empirical research (S. Kaplan, 1973a; 1973b). In one of these, "Cognitive Maps, Human Needs, and the Designed Environment," S. Kaplan identifies the types of environments which would support the information-processing needs as outlined in the first 1972 article and refined in the article under discussion.

> The environment which would support such needs [recognition prediction, evaluation, and action] is one that meets three essential requirements: It is (1) possible to make sense of, (2) novel, challenging, uncertain, and (3) permitting of choice. (S. Kaplan, 1973a, p. 275).

The case for cognitive mapping and for information-processing ability as essential for survival in human evolution is thoroughly presented in "Adaptation, Structure, and Knowledge" (S. Kaplan, 1976). Information processing is discussed from a functional perspective, that is, the everyday need to "get along" in the environment. The interrelated survival issues of strategy, speed, and scarcity in human development are reviewed. Four required information handling capacities are listed--object recognition, anticipation, abstraction and generalization, and responsible innovation. In this context of functional requirements, a proposed mechanism for the cognitive map is explained. Put succinctly, Kaplan defines a cognitive map as "...a network of representations coding both places and sequential relations among them." (p. 37). He concludes the paper with a discussion of path finding and the importance of landmarks and regions. A more detailed review of this work is beyond the scope of this chapter; however, its relevance to the development of a theory of environmental preference should be noted.

The results of two studies are of particular interest to the research application in the present document. Rachel Kaplan (1977a) describes the research conducted on scenery and preference in a roadside and in a storm drain application. These particular settings were selected to represent "everyday nature" so as to demonstrate "...ways in which the assessment of preference can provide useful input for those who effect changes..." (p. 236).

In the roadside study, the objective was to determine if scenery classifications based on distance zones (foreground, middleground, background) or on topographical map categories corresponded to environmental "salience" as perceived by users. Participants were shown photographs which were previously analyzed according to these categories and their preference ratings were elicited. The ratings were subjected to computer dimensional analyses (R. Kaplan 1974; 1975) to determine the groupings of scenes that were meaningful or coherent according to the data. The groupings found were not in agreement with the previously designated categories. Indeed, two of the groupings included "a complete scramble of landform and land-use distinctions" (pp. 238-239). Of interest in the empirically derived groupings was the importance of spaciousness to preference, the more open woodland scenes being highly preferred.

The objectives of the storm drain study were to analyze (1) possible design modifications and improvements and (2) residents' perceptions of possible alterations to their immediate environment. Both photographs and questionnaires were used, along with the dimensional analyses mentioned previously. Four groupings were established--covered drain, impoundment, creek in parklike setting, and backyard-creek. Along with other conclusions, it was determined that "backyard-creek" was among the least preferred, "creek in parklike setting" was consistently highly preferred, and photo versions of "impoundments" were relatively favored. Underlying principles related to the preferences and groupings were apparent upon inspection. Spaciousness, mystery, and especially orderliness were meaningful determinants of preference. Fine textures, an indication of orderliness and legibility, were reflected in the most highly prized scenes. Finally, familiarity appeared as an important predictor of preference particularly as it aided in the ability to "make sense" of the image.

The implications of the storm drain study and others as related to waterscape preference are offered in a paper given at a river recreation management and research symposium (R. Kaplan, 1977b). The affording of a sense of orderliness and spaciousness are reiterated as significant attributes of rivers, as well as the involving component of mystery. This attribute holds particular promise for exploration and further information in the river context. Other "involvement" qualities exhibited by rivers that are likely to enhance enjoyment include movement (and its counterpoint stillness), textural changes, nuances of light and wind, and potential wildlife and vegetative diversity on the riverbank.

The literature reviewed thus far offers a developmental encapsulation of the environmental preference theory and framework of the Kaplans and their colleagues up to 1978. In that year and the one following, two major documents were produced which are extremely useful in understanding the theoretical premises and intricacies involved. Humanscape: Environments for People (S. Kaplan and R. Kaplan (eds), 1978) incorporates the writings of respected leaders from a diversity of disciplines. The underlying theme of the book is the theory of information processing man, the sort of animal that he is, what his concerns are, his processes of perceiving and knowing, how he uses information and what he cares about, and the ways we have of looking at human behavior today. From this base, essays dealing with particular environmental settings (optimal and inadequate ones) and preferences for them, coping strategies, and participation in particular as a strategy for harnessing human energy and creativity while enhancing a reasonable man-environment relationship, are expatiated.

The theory and framework being discussed is perhaps best articulated in Stephen Kaplan's presentation to the visual assessment conference sponsored by the U.S. Forest Service at Incline Village, Nevada (Elsner and Smardon, (eds) 1979). A thorough reading of this article will bring the reader up to date on the subject. Major points will be reviewed here.

Kaplan refers to the recent work of Gibson in the development of a "theory of affordances" as supporting his theory of environmental preference. Gibson's definition of this concept is quite important.

> ...the affordance of anything is a specific combination of the properties of its substance and its surfaces taken with reference to an animal...The affordances of the environment are what it offers animals, what it provides or furnishes, for good or ill. (Gibson, 1977, pp. 67-68)

He continues:

> The definition of an affordance...is a combination of physical properties of the environment that is uniquely suited to a given animal--to his nutritive system or his action system or his locomotor system. (Gibson, 1977, p. 79)

Citing recent work of others in the same vein, Kaplan summarizes the implications of the theory.

> Hence, one can view preference as an outcome of a complex process that includes perceiving things and spaces and reacting in terms of their potential usefulness and supportiveness. In this perspective aesthetics must, at least to some degree, reflect the functional appropriateness of spaces and things. (S. Kaplan, 1979, pp. 241-242)

In discussing the commonly held view that preference is a personal and idiosyncratic phenomena, Kaplan points out that this belief attempts to hold aesthetics in high regard by exempting it from the vagaries of popular consensus. The irony here is that with no underlying consistency of preference, aesthetics becomes trivialized, reduced to mere decoration, and hard to view as being of more than passing significance. By denigrating preference judgments, aesthetics is made inconsequential. Kaplan points out that research indicates preference judgments to be neither random nor particularly idiosyncratic. He adds that preference is no different from other aspects of human behavior and experience in that there is regularity and there is variability.

The majority of the paper is devoted to explaining the most recent version of the matrix framework discussed earlier. The reader will note substantial changes. This framework, and the concepts which constitute it, are essential to understanding the basis for research as it is conducted by the Kaplans. Kaplan explains that their research points to two underlying purposes which concern people.

> We have come to call these persisting purposes "making sense" and "involvement"...Making sense refers to the concern to comprehend, to keep one's bearings, to understand what is going on in the immediate here and now, and often in some larger world as well. Involvement refers to the concern to figure out, to learn, to be stimulated. (S. Kaplan, 1979, p. 242)

Making sense involves the perceived environmental structure, the ease with which it can be characterized, and the presence of affordances that increase the sense of comprehension. The affordances of involvement contain the materials for thinking and understanding and require the mustering of the individuals' cognitive and other skills to process the given information.

Kaplan notes that people seem to relate to the visual environment in a two-dimensional sense (the visual array) and a three-dimensional sense (the pattern of space). He groups the concepts of complexity (an "involvement" component) and coherence (a "making sense" component) together as parts of the visual array.

Level of Interpretation	Making Sense	Involvement
The Visual Array	Coherence	Complexity

Figure 1. Kaplan's theoretical framework (two-dimensional level).

Complexity is defined as reflecting how much there is to look at in a scene. He uses the words "richness" and "diversity" as synonyms. Coherence is described as being those picture plane factors of structure, organization, and comprehension; it is enhanced by patterns or repeated elements which identify "regions" of the visual array.

Drawing analogies with the concepts of "prospect" and "refuge" (Appleton, 1975) Kaplan enumerates two components of the three-dimensional space aspect of environmental perception. He terms these mystery (an "involvement" component) and legibility (a "making sense" component). Thus the complete framework can be sketched.

Level of Interpretation	Making Sense	Involvement
The Visual Array	Coherence	Complexity
Three-Dimensional Space	Legibility	Mystery

Figure 2. Kaplan's theoretical framework (complete).

Mystery involves the opportunity to gather new information. The important distinction is that there need not be the actual presence of new information, only the promise of it. It is also characterized by continuity, the ability to anticipate the new information based on available information. It necessitates the perceived ability to enter the scene and be in control of that decision, hence avoiding fearful encounters yet investigating promising opportunites.

Legibility entails a promise of the opportunity to function (as opposed to mystery in which the opportunity is to learn). It deals with interpretation of space, navigation, and the organization of the ground plane. Legible displays are easy to form cognitive maps of, often contain smooth textures and distinctive elements, and can easily be seen as divided into regions.

Research results are referred to as indicating that the two levels of analysis (the visual array and three-dimensional space) may not be of equal importance. In terms of preference, a modicum of complexity and coherence are required for high ratings, but high values of each do not apparently lead to a direct increase in preference. Mystery and legibility, on the other hand, have been found to influence preference throughout their range. Kaplan ends the paper with a recapitulation of the theory and concepts presented.

> What I would like to propose is a functional approach, a view of what people are trying to do. When people view a landscape they are making a judgment, however intuitive and unconscious this process may be. This judgment concerns the sorts of experiences they would have, the ease of locomoting, of moving, of exploring, in a word of functioning, in the environment they are viewing. (S. Kaplan, 1979, p. 247)

Summary

This chapter has described the two basic types of approaches used in visual assessment and reviewed the literature dealing with two subtypes--the qualitative descriptive inventory and the theoretically-based empirical perceptual preference approach. The work of R. Burton Litton, Jr. and of Stephen and Rachel Kaplan exemplify these approaches. Litton's concept of visual units derived from biophysical features in the landscape and Kaplans' perceptual predictor variables of coherence, complexity, mystery, and legibility have been discussed in detail. As stated in Chapter One, the relationship of these concepts among themselves and to preference will be explored. The specific methodology used for data collection and analysis is the subject of Chapter Three.

CHAPTER III

METHODOLOGY

Introduction

The methods of data collection for the two approaches to visual assessment under discussion are quite different. As mentioned earlier, the Cutler Reservoir and tributary streams in Cache County, Utah were the subject of a previous qualitative descriptive inventory from which specific visual units were selected for this study. Color transparencies of the units selected were chosen as the vehicle to explore the relationship to the perceptual variables selected from the theoretically-based empirical perceptual preference approach. A brief overview of the procedure and results of the previous study will be given along with a discussion and description of the visual units and slides selected for this continued research. Then the method used for the data collection related to the perceptual variables will be presented.

Visual Units Data Collection

The qualitative descriptive inventory approach was used to describe and inventory the biophysically-based visual resource of Cutler Reservoir and its tributary streams (Ellsworth, 1980) (see Appendix E). Six visual units at the setting unit scale and nine visual units at the waterscape unit scale were identified. These units were based on similarities and consistencies in stream expression, vegetation type, edge condition, human use and impact, and geographic location. Field visits, map interpretation, photographic documentation, and best professional judgment of the principle investigator were key elements of the research.

Five visual units were selected to be used in the present study. Two river setting units, each incorporating two waterscape units, were selected along with the single marsh setting unit identified. This allows research that explores the visual salience of the different scales of visual units as well as comparisons of landscape types and visual units in terms of preference. The relationship of perceptual variables to different units, to rivers and marshes, and to preference can then be investigated.

Biophysical factors identified in each of these units are shown in Figure 3. For ease of reference, a summary of units and their general exhibition of water expression, edge condition, vegetation type, and human use and impact is made in Figure 4. The reader should note that the diversity of factors in Figure 3 is not as clearly expressed in Figure 4 due to the broader categories used. This should not be construed as a diminution of the perceived visual differences between units.

Perceptual Variables and Preference Data Collection

Numerous studies have demonstrated the reliability and validity of using photographs to represent the natural environment (R. Kaplan, 1979a; Boster and Daniel, 1972; Zube, 1974; Rabinowitz and Coughlin, 1970; Shafer and Richards, 1974; Levin, 1977; Zube, Pitt, and Anderson, 1975; Coughlin and Goldstein, 1970; Daniel and Boster, 1976). This strong relationship between photographs and on-site experience is explained by S. Kaplan in the context of human information processing theory.

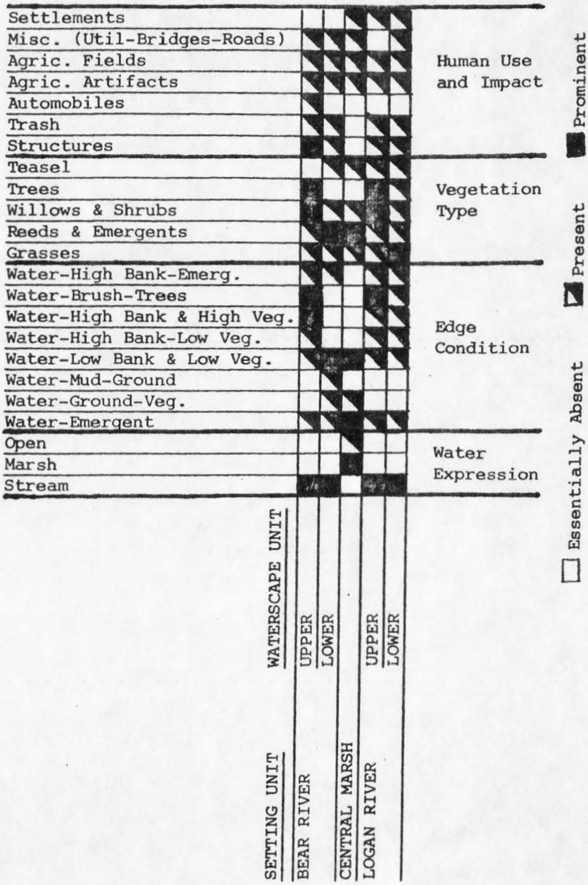


Figure 3. Biophysical factors in visual units.

VISUAL UNIT	BIOPHYSICAL FACTORS
Logan River Setting Unit	
Upper Waterscape Unit	Stream Expression Continuous Edge High Vegetation Low Human Use and Impact
Lower Waterscape Unit	Stream Expression Continuous Edge Low/Med. Vegetation Medium Human Use and Impact
Bear River Setting Unit	
Upper Waterscape Unit	Stream Expression Continuous Edge High Vegetation High Human Use and Impact
Lower Waterscape Unit	Stream Expression Continuous Edge Med./Low Vegetation Low Human Use and Impact
Central Marsh Setting Unit	
	Marsh Expression Discontinuous Edge Medium Vegetation Low Human Use and Impact

Figure 4. Summary of biophysical factors in selected visual units.

> ...the perception of space is highly inferential. We construct our spatial world through the selection, analysis, and interpretation of spatial information. This inferential process takes a two-dimensional pattern of light falling on the retina and interprets it in three dimensions. (Thus, the spatial interpretations that participants make of two-dimensional photographs in our own research and in other studies is hardly surprising. The perceptual apparatus is highly biased toward spatial interpretations, and people in our society have extensive experience with photographs as representations of the three-dimensional world. To criticize photographs as artificial and inadequate in landscape research is to fail to appreciate the nature of human perceptual mechanisms.) (S. Kaplan, 1975, p. 93)

There were five primary criteria in selecting slides for this research: (1) The range of biophysical factors in each of the five visual units must be adequately represented (S. Kaplan, 1981); (2) there must be adequate instances of all levels of the perceptual predictor variables being tested (R. Kaplan, 1981); (3) maximum variability should be sought (in terms of time of day, season of year, weather conditions, etc.) so as to achieve external validity in the results (generalize beyond the single environmental setting being studied) as well as internal validity (consistency within the study) (R. Kaplan, 1981); (4) there should be enough slides to represent the categories being investigated, but not so many that participants become tired or bored (somewhere between twenty and seventy is reasonable) (R. Kaplan, 1981; S. Kaplan, 1981; R. Kaplan, 1979b; Daniel and Boster, 1976); (5) there should be no animals or humans present in the images (S. Kaplan, 1981) due to the strong reactions people have to them (Kaplan and Kaplan (eds.), 1978); and primary landscape features such as water should be carefully represented so as not to bias the preference ratings (S. Kaplan, 1975, 1981). These five criteria imply another one--that slide selection will necessarily be a selective process rather than a random one. This conclusion is consistent with R. Kaplan's methodology (1981). It should be noted that S. Kaplan (1981) and R. Kaplan (1981) were personally contacted and offered direction and rationale for the methodological decisions to be discussed throughout the remainder of this section.

Following these guidelines, 76 slides were selected by the author from a group of more than two hundred. They represented the five visual units in relatively equal numbers, although expert statistical advice indicated that equal numbers of slides within units or equal numbers of units per landscape type was probably not critical (Sisson, 1981). These slides also exhibited a relatively wide range of the perceptual variables being tested as judged by the author. All slides contained water images; none contained animal or human images. The photographs were taken over a three-season period (Spring through Fall) and at different times of day, therefore rendering the necessary variability for external validity.

To determine the relative degree of expression of the four perceptual variables in the slides and, therefore, between visual units (see research question number I), the slides were shown to panels of judges who were asked to rank each slide for the presence of the perceptual variable being studied. This process is consistent with Kaplans' techniques (Gallagher, 1977; R. Kaplan, 1973, 1975) with slight variations to fit the objectives of this particular study. In selecting judges, no special skills were required. The participants only needed to understand the concept being investigated and have the time and willingness to pursue the exercise. The judges selected were

18 senior and graduate landscape architecture students. They were divided into three groups of five and one group of three. Each participant was given a slip of paper with a written description of the concept being discussed (see Appendix B). Each group dealt with a different concept--coherence, complexity, mystery, or legibility. These were identified by number and not by name in order to avoid any personal connotations that might interfere with the specific definition being used. In each group, the concept was discussed, then random slides selected from the set of 76 were projected. Participants then expressed their perceptions of the extent of expression of the concept in those slides. When everyone in the group expressed confidence in understanding the concept and being able to rank its expression in a slide, they were instructed to assign a value on a whole number scale of one to five for the expression of the concept--a "one" being little or no expression and a "five" being high expression. They were encouraged to use the entire range of the scale. All 76 slides were viewed by each group for approximately two and one-half hours per concept. The participants were encouraged to express opinions on their rankings and discuss them among themselves. The definitions were repeatedly read to them as they viewed the slides to assure that all facets of the concepts were being evaluated.

The rankings of all judges in each group were averaged for each slide for statistical purposes. Although there were instances where individual rankings on a particular slide covered a wide range on the five-point scale, the great majority of them were in close agreement. One of the advantages of using multiple judges is in offsetting this effect. Group discussion prior to and during the ranking exercise was encouraged in the hope that each person's individual scaling system would be tempered and honed by the additional information of his colleagues and thus the overall range of agreement would be tighter. Definitions for the perceptual variables used in the exercise are given in Appendix B. Sources for each definition are shown in parentheses.

Sixty of the 76 slides were then selected based on the five criteria mentioned earlier. Ten slides were selected from each of the four river waterscape units (yielding 20 per river setting unit) and 20 from the marsh setting unit. They exhibited a range of biophysical factors (see Appendix A, Table 13) and a range of judges' rankings for perceptual variables (see Table 14). The necessary variability and presence of water as discussed earlier was maintained. Representative slides from each unit are shown in Figure 5. The slides, numbers and corresponding visual units are listed in Table 12 (Appendix A).

To determine relative preferences for visual units (see research question number II), preference ratings were elicited from college students--a valid and accepted practice in this type of research (R. Kaplan, 1973; Daniel and Boster, 1976; Palmer and Zube, 1976). Preference ratings should be done by people other than the perceptual variables judges for two reasons (R. Kaplan, 1981). First, preference requires a larger group for statistical purposes. Second, there may be contamination of preference ratings by forced evaluation of other concepts; for example, people evaluating both coherence and preference may rank preference high on one slide because it is high in coherence and they recall ranking a previous slide in a similar fashion.

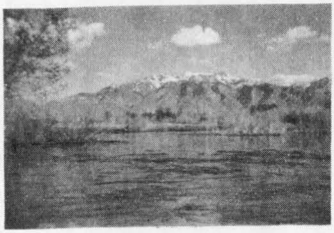
The 60 slides were mixed, then randomly loaded into two slide carousels (cf. Daniel and Boster, 1976). A group of 98 students in an introduction to landscape architecture class were chosen as preference

LOGAN RIVER SETTING UNIT

Upper Waterscape Unit

Slide #33

Lower Waterscape Unit



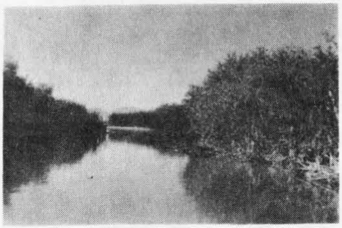
Slide #29

BEAR RIVER SETTING UNIT

Upper Waterscape Unit

Slide #14

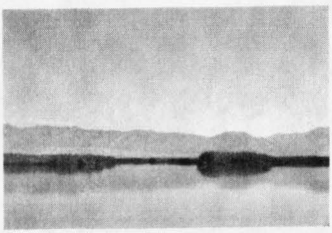
Lower Waterscape Unit



Slide #6

CENTRAL MARSH SETTING UNIT

Slide #44



Slide #50

Figure 5. Representative slides from each visual unit.

respondents in the belief that they would represent demographic diversity in age, sex, academic major, and home state (see research question IIc). A response form was developed (Appendix C) which incorporated this data along with instructions and a five-point ranking scale for each slide.

The 98 participants were divided into two groups and sequestered in separate rooms to view the slides. They were asked to evaluate each scene according to its own merit (not in comparison to the others in the set) based on the question "how pleasing do you find the scene, or how much do you like the scene?" (R. Kaplan, 1973, 1975; Herzog, Kaplan and Kaplan, 1976). They were encouraged to use the entire range of the five-point scale. Three practice slides were shown and questions answered concerning the procedure. The 60 slides were displayed in opposite sequences to the two groups so as to minimize the effect of fatigue or boredom and to allow statistical comparisons to detect these potential effects. Each slide was displayed for ten to fifteen seconds (R. Kaplan, 1973, 1975). A five-minute break was given halfway through, allowing the two slide carousels to be exchanged between the two viewing rooms (therefore only one set of slides was necessary). The exercise proved to be an easy task with no complaints or disgruntlements expressed. Chapter Four presents the data gathered, professional analyses, mathematical and statistical analyses employed, and results obtained.

Summary

The methods of data collection for examining the relationship of visual units, perceptual variables, and preference have been presented in this chapter. Visual units from the Cutler Reservoir study (Ellsworth, 1980) as expressed in color slides were rated by trained judges for the degree of expression of the perceptual variables of coherence, complexity, mystery, and legibility. The same slides were rated for preference by another group of respondents. Through professional judgment and statistical analysis, the relationship of these three research variables--visual units, perceptual variables, and preference--can be examined.

CHAPTER IV

RESULTS

Introduction

This chapter presents and discusses the data gathered, the professional analyses, and the mathematical computations and statistical analyses accomplished according to the methodology presented in Chapter Three. Slides representing visual units are displayed along with tables listing the biophysical aspects exhibited in the slides within each unit. The judges' ratings of the slides for the perceptual variables and the respondents' preference ratings are reported in table form. Slides are included that illustrate the range of ratings obtained. The effect of demographic variables on the preference ratings are also discussed.

The following figures and tables of data are included in the appendix:

Table 12: Study Slides' Numbers and Visual Units Represented

Table 13: Presence of Biophysical Factors in Study Slides' Visual Units Matrix

Table 14: Judges' Mean Ratings of Perceptual Variables Per Slide

Table 15: Individual Respondents' Preference Ratings Per Slide

Table 16: Preference Mean Ratings for Each Respondent Per Visual Unit

Figure 8: Study Slides

Data Analysis

The majority of the data analysis involved professional judgment, mathematical computations and statistical procedures that were carried out with the use of a computer and expert statistical advice (Sisson, 1981; Kolesar, 1982) on the campus of Utah State University. In some cases comparisons and examinations of the slides were made based on the raw data prior to the use of the computer in order to arrive at reasonable statistical approaches. The data gathered and the professional, mathematical and statistical procedures used in the data analysis will be discussed in the context of the research questions as stated in Chapter One.

Research question number one. Part A: What is the relative degree of expression of the perceptual variables of coherence, complexity, mystery, and legibility in riverscapes, marshscapes, setting units, and waterscape units?

The judges' mean ratings for each of the perceptual variables per slide provide the data for answering this question (see Table 14 in Appendix A). The ratings for all the slides in each unit were averaged. This gave the expression of each variable on a relative scale per landscape type or visual unit (Table 1). Examination of these results indicates relatively high ratings of complexity and mystery in the Logan River scenes at both the waterscape unit and setting unit scale; relatively high ratings of coherence and mystery in the Bear River scenes at both scales; and a relatively high rating of coherence in the marsh scenes. The Bear River lower waterscape unit scenes exhibit relatively higher ratings of legibility. Low relative ratings of mystery and legibility occur in the central marsh scenes. Figure 6 illustrates the typical range of ratings in example slides.

The author's professional judgment of the factors contributing to the expression of the perceptual variables in the slides representing

TABLE 1

JUDGES' MEAN RATINGS FOR PERCEPTUAL VARIABLES IN EACH VISUAL UNIT

Visual Unit	Coherence	Complexity	Mystery	Legibility
Logan River Setting Unit	3.40	3.70	3.75	3.20
Logan River Upper Waterscape Unit	3.50	3.90	3.90	3.20
Logan River Lower Waterscape Unit	3.30	3.60	3.60	3.20
Bear River Setting Unit	3.85	3.35	3.70	3.35
Bear River Upper Waterscape Unit	3.50	3.60	3.50	3.10
Bear River Lower Waterscape Unit	4.20	3.10	3.90	3.60
Logan River and Bear River Combined	3.63	3.53	3.73	3.28
Central Marsh Setting Unit	4.60	3.05	2.50	2.80

All ratings based on a 5-point scale.

COHERENCE

Slide #37 Rating: 5

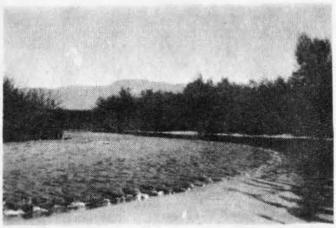
Slide #39 Rating: 2

COMPLEXITY

Slide #1 Rating: 5

Slide #17 Rating: 2

MYSTERY



Slide #30 Rating: 4

Slide #31 Rating: 1

LEGIBILITY

Slide #34 Rating: 5

Slide #52 Rating: 2

Figure 6. Representative range of perceptual variables ratings in slides.

the four river waterscape units and the single marsh setting unit will be discussed in the context of each perceptual variable. This allows comparisons of trends, consistencies, and distinctions in the biophysical and visual factors affecting the expression of these perceptual variables across visual units.

● Coherence: As defined in this study, coherence is expressed by those factors which make the two-dimensional "picture plane" easier to organize, to comprehend, or to structure (Appendix B). In all the slides, both river and marsh, the continuity of water is the strongest factor influencing coherence. The ratings in the units range from 3.30 to 4.60, attesting to the powerful influence of this primary landscape feature on coherence.

In the Logan River upper waterscape unit the ratings range from 3 to 5. The slides with the highest ratings seem to be influenced by edge definition, vegetation height, and contrasting shadow patterns that aid in the delineation of "areas" of the picture plane. Water edge is generally well-defined by encroaching thick vegetation, giving an orderly character to the stream (see slide #8). Vegetation is typically high (mature trees and brush) and of similar texture and density (see slide #33). Deep shadows of the edge vegetation and the reflection of the vegetation on the water surface aid visual organization of the picture plane (see slide #49). The presence of abandoned automobiles and other trash on the bank of the stream does not appear to affect the rating of coherence (compare slides #32 and #34 with ratings of 4 and 3 respectively). The slides with lower ratings of coherence differ from those with higher ratings in the increased diversity of vegetation height and texture (see slides #8 and #19) while edge definition remains clean and orderly.

In the Logan River lower waterscape unit coherence ratings range from 2 to 4. The higher rated slides frequently are well-organized with water dominating the foreground, a low bank in the middleground which aids in dividing the scene into "areas", and strong background definition by trees or mountains (see slides #12, #22 and #45). Vegetation heights may be mixed but exhibit similarities in color, density, and texture (see slide #53). Trash on the bank does not affect the higher ratings (see slide #45, rating of 4). The scenes with lower ratings often have deep shadows over a major portion of the image which obscure detail and inhibit the clarity (see slides #7 and #39). There is also a diversity of vegetation heights that frequently breaks the continuity of the display from edge to edge (see slides #59, #7 and #39).

Ratings of coherence in the Bear River upper waterscape unit range from 3 to 4. As seen in the Logan River, higher rated slides exhibit similarities in vegetation height, texture, and color/value. Human use and impact is minimal (see slides #54 and #60). Lower rated images have more diversity in vegetation, especially the extremes of tall trees and low banks (see slides #27 and #51). There are conspicious and inconspicuous human intrusions in nearly all the slides rated 3. It appears that some of these intrusions tend to break up the perceived structure of the scene.

The Bear River lower waterscape unit shows the highest rating of coherence of the four river waterscape units (4.20). Nine of the images received a rating of 4 or 5 by the judges; the tenth was rated 3. Similarities in vegetation texture, height, and continuity across the image can be interpreted as strongly influencing the high ratings (see slides #9, #17, and #38). Where textural variations occur, caused by either different species or the effect of distance, and where breaks occur in the "flow" of vegetation across the scene, the ratings of coherence drop (see slides #21 and #30, rated 3 and 4 respectively).

The Central Marsh setting unit was considered by the judges to be extremely coherent (mean rating = 4.60). The majority of the scenes rated 5 were of uniform vegetation height, density, texture, and species. The scenes are very well organized with water in the foreground, a middle-ground band of vegetation, either no background or mountains of consistent form and texture, and an expanse of clear or sparsely clouded sky (see slides #37, #42, and #58). The marsh images are characterized by redundant elements that make the two-dimensional order and structure clearly apparent. The two displays that were rated 3 differ from the others in the amount of middle and background visible, the inclusion of more vertical elements (background trees), and textural diversity (see slides #13 and #31).

In summary, coherence seems to be highly expressed in river scenes where vegetation height, density, and texture are similar. Strong edge definition and a sense of orderliness or containment of the water are important. Trash and other human intrusions do not seem to have a consistent effect on the rated values of coherence. Although there are slight differences in the ratings between visual units at the setting unit and waterscape unit scale caused by other influences, the determining factors remain vegetation type and edge expression. The marsh environment is considered much more coherent, due to the strong similarities in vegetation and the strong horizontal organization of the basic biophysical attributes.

- Complexity: Complexity is defined as the number of visual elements in a scene, how intricate the scene is; whether it contains many different elements (Appendix B). The constant feature of water, expressed in all the scenes in this study, is not as strong an influence on complexity as it is on coherence. The water images vary only slightly in surface texture. There are smooth surfaces and ripples, but no fast, cascading, or falling water. For this reason, complexity is expressed most clearly in other aspects of the photographs.

In the Logan River upper waterscape unit, the ratings for complexity range from 3 to 5. The higher rated scenes exhibit a diversity of vegetation heights and textures (see slides #19 and #26). Background views are likely to be of conspicuous mountain ranges with strong textures expressed by snow and vegetation (see slides #19 and #32). Trash on the banks adds to how much is "going on" in any particular scene (see slides #32 and #34). The lower rated slides express a striking uniformity in vegetation textures and heights (see slides #8, #10, #11, and #49--all rated 3).

The Logan River lower waterscape unit's ratings for complexity range from 3 to 4, a very tight and moderate range. Vegetation diversity is not as clearly expressed in the scenes rated 4; however, the number of visual elements in the scenes is greater than in the scenes rated 3 (compare slides #45 and #47 to #22 and #53). There also appears to be more visible depth in the higher rated slides (hence increased visual access to different elements). In a related fashion, the presence of a strong background in the higher rated slides is not present in the lower rated ones (compare slide #12 to slide #39).

Ratings for complexity in the Bear River upper waterscape unit range from 2 to 5. Slides rated 4 and 5 display a predominance of diverse structures in an agricultural setting (see slide #1), fine detailed foreground vegetation textures and heights (see slide #41), a diverstiy of vegetation textures (see slide #54), and a visible and textured background of mountains with snow (see slide #51). Slides with lower ratings (3 and 2) have less diversity of vegetation textures (although vegetation height may still be diverse--see slides #27 and #60). Background in these images is either non-existent (see slide #2) or hazy without strong textures (see slides #3 and #60). Human impacts occur in the lower rated slides; however, they are either very subordinate (see the bridge in slide #60) or they blend fairly well with the existing colors, textures, and lines of the scene (see the bridge in slide #3).

Complexity ratings in the Bear River lower waterscape unit also range from 2 to 5. A mix of vegetation, water, bare ground and drift-wood can be seen in the slides rated 4 and 5 (see slides #9 and #30). Although the vegetation heights are similar, there may be two or three distinct textural classes (again, see slides #9 and #30). The images rated 2 by the judges show little bare ground and a uniformity of vege-tation height, texture, and species (see slides #6, #17, and #38).

Although the complexity mean rating for all the slides in the Central Marsh setting unit is quite moderate (3.05), the 20 slides in the set exhibit the full range of ratings from 1 to 5. The images rated 4 and 5 feature foreground vegetation that is dispersed, upright, and visually strong (see slides #4 and #31). At the same time, the view of the middleground and background is unobstructed, revealing diverse vegetation, land use, and textural patterns (see slide #13). This rich-ness of texture enhanced by increased depth is obvious in its effect on complexity in comparison to the slides rated 1 and 2. These images are dominated by foreground and middleground views (see slides #50 and #58).

There is invariably a band of monotonous vegetation at one or both of these distance zones, usually there is a visually nondescript mountain range in the background, and essentially no other features are visible (see slides #15, #57 and #58).

In summary, the four river waterscape units exhibit levels of complexity dependent upon a number of factors. Diversity in vegetation height, density, and texture yields higher ratings. Also, increased numbers of elements (water, vegetation, land use patterns, trash, textured background) heightens perceived visual complexity. Fewer differences in elements, textures, and backgrounds lower complexity appraisals. The degree of visual depth affects the complexity ratings for marshes as well as for rivers. Marsh scenes with strong and dispersed foreground vegetation are considered more complex, while scenes dominated by uniform distributions of vegetation are clearly considered less complex.

● Mystery: Mystery is expressed where going further into the scene seems likely to provide more information or where there is the promise of further information based on a change in the vantage point of the observer (Appendix B). Water, particularly as expressed in rivers, is very conducive to the expression of mystery. The bend in the stream, the obscuring foliage, and the smooth surface texture combine to invite exploration of the scene. As would be expected, the mean ratings of the judges reflect this promised information quality of rivers (3.73 for all river units combined), while suggesting the lack of important aspects of this concept in marshes (mean rating 2.50).

The Logan River upper waterscape unit received one of the highest ratings for mystery (3.90). Bends in the river and multiple channels were depicted in highly rated scenes (see slides #19 and #26). Scenes with indistinct or shadowed focal points were also highly rated (see slide #49). Obscuring foliage (see slides #11 and #56) heightened the sense of mystery as did the presence of a landmark tree at the end of a long stream reach (see slide #8). High banks with smooth textures that blocked the view of the middle ground were considered to express a high degree of mystery (see slide #32). Lower ratings of 2 were assigned to scenes displaying long, straight corridors bounded by fairly regular vegetation and with no bends or obscuring foliage (see slides #10 and #34). In these scenes, it certainly appears possible to enter the scene, but it is not clear if there is any particular place to go or the promise of any new information. It seems that any information is likely to be similar to what is already depicted in the scenes.

The range of judges' ratings for mystery is from 3 to 5 for the scenes from the Logan River lower waterscape unit. The closely cropped river banks typical of this unit facilitate the expression of mystery. Scenes with both high banks (see slide #12) and low banks (see slide #47) were rated high in mystery. It also seems that the presence of agricultural artifacts on these banks may stimulate interest and suggest the promise of new information (related to agriculture in some way) if the viewer were to gain the new vantage point atop the bank (see slides #35 and #39). Straight reaches and indiscernible stream flow direction decreased the sense of mystery (see slides #59 and #7). Banks that were too low to provide a new vantage point (see slide #45) or that were not accompanied by obscuring vegetation in the water and glimpses of background (compare slides #47 and #22, rated 4 and 3 respectively) were not considered especially "mysterious."

The Bear River upper waterscape unit was assigned the lowest overall mystery ratings of the four river units; however, the expression is still fairly high (3.50). The range of ratings is tight and moderate (3 to 4). Two of the scenes rated 4 displayed obscuring bands of vegetation across the entire image, with either a small revealed view (see slide #27) or a visible background with no hint of what lay in the middleground (see slide #41). Similarly, a bridge obscuring the view down river added to the mystery (see slide #3). As in the other river units, stream reaches extending to some distance with a bend at the end received high ratings (see slides #14 and #43). Scenes in which the path of the river was indistinct (see slide #60) or where structures dominated the potential vantage point of a high bank (see slide #1) were considered of lower mystery.

Tightly enclosed river channels with bends and distant openings were considered to express a high degree of mystery in the Bear River lower waterscape unit (see slides #6, #18, and #30). Where there were two distant channels which had to be reached by first crossing a relatively open expanse of water, mystery was evident (see slides #40 and #21). These images also portray foreground vegetation that suggest new information by navigating around it (see also slide #38). As seen in the other river units, scenes with long reaches without bends and with monotonous vegetation were rated lower (see slide #17). A scene with sandy shore offering very little change in vantage point was also rated low (see slide #9, rated a 2).

The Central Marsh setting unit photographs contained significantly less mystery than the river scenes as assessed by the judges. The range was from 1 to 4, with the majority of the slides rated 2. Those scenes that were rated higher in mystery depicted foreground vegetation that could be gone around (see slides #13 and #44) or where the sense of enclosure, direction, and focus were enhanced by the vegetation position and distribution (see slide #42). The lower rated images exhibited two distinct aspects that negatively affected the promise of new information. In some scenes, there was a foreground or middleground vegetative barrier to progressing further into the scene (see slides #46, #57, and #58). In others, there were multiple indistinct openings in the vegetation that allowed passage, but did not suggest any strong possibility of gaining new information (see slides #28, #31, and #50).

It can be said from this analysis of mystery ratings that river scenes were considered to express the concept more than marsh scenes. The bend in the river, the obscuring foliage, and the riverbank that offered a new vantage point all contributed to this expression. Straight reaches and blocked views generally detracted from the feeling of mystery. In the marsh photographs, mystery was highest where there was obscuring foreground vegetation, and lowest where there were vegetative barriers to passage or multiple options, none of which promised any new information.

● Legibility: Legibility is defined as involving a promise of the opportunity to function, as being concerned with the interpretation of space, and as involving the ease with which one can perceive space as divided into sub-areas or regions (Appendix B). Two aspects of legibility are pertinent to water, particularly as represented in this study. Smooth textures often aid the perception of legibility because such surfaces are more easily comprehended and organized. Likewise, spaces with flat ground planes are easily comprehended and organized.

The judges' mean rating for legibility in the Logan River upper waterscape unit is 3.20; the range of ratings on the 10 slides is from 1 to 5. The most legible scenes are those with the long, straight reaches bounded by a continuous, uniform vegetative edge (see slides #8, #10, and #34). The scenes with strong vegetative enclosure, contrasting and defining the planar quality of the stream, are also high in legibility (see slide #49). These images portray a clean, spacious feeling that is very easily organized by the viewer. Photographs that received lower ratings often show a varied edge (see slide #19), bends or multiple channels (see slides #26 and #33), and more exposed background views which imply but do not define middleground spaces (see slides #19 and #26).

The Logan River lower waterscape unit's legibility mean rating (3.20) and range of ratings on the slides (1 to 5) is identical to those of the upper waterscape unit. The long, straight stream reaches are considered highly legible in this unit also (see slides #59 and #35). Strong enclosures aid legibility; however, in this unit the high banks are more important than vegetation in achieving this effect (compare slides #39 and #12 to #59). The fine textures of the grass-covered banks increase the promise of the opportunity to function. Scenes depicting a broken or indistinct edge (see slide #47), vegetation in the water which compromises the smooth texture of the water (see slide #29), and an unclear transition from foreground through middleground to background (see slide #45) were seen by the judges as being less legible. Displays that exhibited a greater diversity of textures tended to be less legible (compare slides #22 and #29, rated 4 and 2 respectively).

The Bear River upper waterscape unit has the lowest legibility mean rating of the four river waterscape units (3.10). As in the Logan River units, the straight stream reaches, tightly enclosed, are most legible. The enclosure may be expressed by vegetation (see slides #2 and #14) or by high banks (see slide #51). Where the stream definition is unclear, as in oblique views to the edge, the ratings are moderate (see slides #1, #27, and #54). The medium rating was also assigned to views where a space was suggested but obscured by foliage (see slides #27 and #41). The lowest possible ratings occurred where a bridge transected the major space (see slide #3).

The highest mean rating for legibility (3.60) occurred in the Bear River lower waterscape unit. The range of ratings was from 2 to 5, with the highest rated slides featuring a gently curving or straight river corridor with strong, regular vegetative enclosure (see slides #6, #17, #18 and #30). Displays in which the foreground space was simple and well-defined, with other spaces subordinate, were also judged very legible (see slides #9, #21, and #38). Photographs that portrayed poorly defined single or multiple spaces were not rated particularly legible (see slides #36 and #40), nor was the image of a distant and obscure middleground space (see slide #25).

The Central Marsh setting unit's mean rating for legibility was 2.80, noticeably less than the mean ratings for the river units. The range of ratings was concentrated at the medium and low end of the scale (one slide rated 1, five rated 2, and 11 rated 3). Two of the scenes rated 4 were of simple foreground water with an impenetrable vegetative barrier that directly defined the space opposite the viewer and implied enclosure at the edge of the scene (due to the regularity and density of the plants) even though such a lateral boundary was not visible (see slides #46 and #57). The third highly rated slide showed one single space extending from the foreground into the middleground where it was well contained by the typical marsh plants (see slide #13). The displays that were judged of lowest legibility featured space broken up by intermittent vegetation (see slides #4, #31, and #55), random and scattered spaces caused by uneven vegetative distribution (see slides #16 and #52), and an image which was a combination of these two patterns (see slide #28). The majority of the scenes rated 3 were also of multiple spaces poorly defined by random vegetative patterns (see slides #5, #42, and #50).

The expression of legibility in river scenes can be summarized as related to a number of features. Straight, enclosed stream reaches are especially important to legibility. Fine textures and a regular, continuous edge are present in highly legible scenes. Where the edge is broken, the stream curves, vegetation intrudes into the water surface, or the stream flow direction is unclear the aspect of legibility will be diminished. Multiple or obscured spaces inhibit legibility. In the marsh photographs, simple spaces bordered by regular vegetation appears to be essential. When the spaces are weakened by intermittent vegetation or when the edge is poorly defined, there is a loss of legibility.

These observations are valuable in understanding how the landscape types and visual units differ in their expression of the four perceptual variables and how the variables are expressed in the images surveyed. Statistical analysis as suggested in the second part of this research question helps to clarify significant differences in these judges' ratings.

Part B of question one is: Are there statistically significant differences in the degree of expression of the perceptual variables between the two landscape types (rivers and marshes), between setting units, or between waterscape units within the same setting unit?

Each perceptual variable was subjected to an analysis of variance using the judges' mean ratings for the marsh setting unit and the river waterscape units as treatments. The F-test (when comparing groups of treatments) and the least significant difference test (when comparing pairs of treatments within the groups) were used to determine which, if any, of the landscape types, setting units, or waterscape units were having a statistically significant effect in explaining the variance in the ratings (per perceptual variable). A significant F-test or LSD test would indicate if the degree of expression was significantly different between any of the treatments or combinations of treatments.

As seen in Table 2, the F-test indicated no statistically significant differences between treatments (visual units) for the perceptual variables of complexity ($F = 1.918$ with 4,55 d.f.) or legibility ($F = 1.192$ with 4,55 d.f.). The implications are that the variability in the judges' mean ratings for these variables is not explained by the different visual units.

The F-test did, however, indicate statistically significant differences in the judges' mean ratings between units for coherence ($F = 10.151$ with 4,55 d.f.) and mystery ($F = 7.762$ with 4,55 d.f.) (Table 3). These F values are significant at the .005 level. Similar F-tests were conducted to ascertain if the significant differences in the

TABLE 2

ANALYSIS OF VARIANCE--COMPLEXITY AND LEGIBILITY

Complexity

Source	df	Mean Square	F
Total	59		
Treatment	4	1.658333	1.918156*
Error	55	0.8645455	

Treatment	Treatment Means
1 (Logan River Upper)	3.90
2 (Logan River Lower)	3.60
3 (Bear River Upper)	3.60
4 (Bear River Lower)	3.10
5 (Central Marsh)	3.05

Legibility

Source	df	Mean Square	F
Total	59		
Treatment	4	1.120833	1.192376*
Error	55	0.9400000	

Treatment	Treatment Means
1 (Logan River Upper)	3.20
2 (Logan River Lower)	3.20
3 (Bear River Upper)	3.10
4 (Bear River Lower)	3.60
5 (Central Marsh)	2.80

*not significant

TABLE 3

ANALYSIS OF VARIANCE--COHERENCE AND MYSTERY

Coherence

Source	df	Mean Square	F
Total	59		
Treatment	4	4.337500	10.15160*
Error	55	0.4272727	

Treatment	Treatment Means
1 (Logan River Upper)	3.50
2 (Logan River Lower)	3.30
3 (Bear River Upper)	3.50
4 (Bear River Lower)	4.20
5 (Central Marsh)	4.60

Mystery

Source	df	Mean Square	F
Total	59		
Treatment	4	5.320833	7.762489*
Error	55	0.6854545	

Treatment	Treatment Means
1 (Logan River Upper)	3.90
2 (Logan River Lower)	3.60
3 (Bear River Upper)	3.50
4 (Bear River Lower)	3.90
5 (Central Marsh)	2.50

*significant at .005 level

judges' ratings were present between the two river setting units, between each river setting unit and the marsh setting unit, and/or between both river setting units combined and the marsh setting unit for both coherence and mystery. In addition, least significant difference tests were conducted on waterscape units within each river setting unit (Table 4).

All F-tests indicated significant differences in the mean ratings (to the .005 level) with the single exception of the mystery ratings between the Logan River setting unit and the Bear River setting unit. Only one pair of waterscape units' ratings (coherence between Bear River upper and Bear River lower) were shown to be statistically different according to the LSD test (a difference of 0.70 with LSD = 0.586).

In summary, based on the results of the analyses of variance there do seem to be statistically significant differences (or explanations of variability) in the judges' mean ratings for coherence and mystery at the landscape type (rivers and marshes) and the setting unit scales of analysis. There appear to be significant differences in the ratings for coherence between two of the four waterscape units. There are no statistically significant differences (or explanations of variability) in the ratings between units for complexity or legibility. The implications here are: (1) perceived differences in expressions of coherence and mystery between rivers and between rivers and marshes are meaningful; (2) perceived differences in the expression of coherence between one pair of waterscape units are meaningful; and (3) perceived differences in expressions of complexity and legibility between visual units are not as meaningful. These findings are basically congruent with the professional judgment of the expressions of these variables in the different units as discussed in part A of this question.

TABLE 4

F-TESTS AND LSD TESTS FOR COHERENCE AND MYSTERY

RATINGS BETWEEN VISUAL UNITS

Coherence F-tests		
Units compared		F
Logan River Setting Unit to Bear River Setting Unit		4.739*
Logan River Setting Unit to Central Marsh Setting Unit		33.702*
Bear River Setting Unit to Central Marsh Setting Unit		13.164*
All Rivers to Marsh		29.665 *
Coherence LSD Tests		
Units compared	Difference	LSD
Logan River Upper to Logan River Lower	0.20	0.586
Bear River Upper to Bear River Lower	0.70**	0.586
Mystery F-tests		
Units compared		F
Logan River Setting Unit to Bear River Setting Unit		0.03647
Logan River Setting Unit to Central Marsh Setting Unit		22.795*
Bear River Setting Unit to Central Marsh Setting Unit		21.007*
All Rivers to Marsh		119.145*
Mystery LSD Tests		
Units compared	Difference	LSD
Logan River Upper to Logan River Lower	0.30	0.742
Bear River Upper to Bear River Lower	0.40	0.742

*significant at .005 level
**significantly different

Research question number two. Part "A": What are the relative preferences people express for riverscapes, marshscapes, setting units, and waterscape units?

The respondents' preference ratings provide the raw data relevant to this question (Appendix A, Table 15). For statistical purposes the preference mean ratings of all respondents on all the slides in each landscape type or visual unit were calculated (Table 5). From this data, the relative preferences among landscape types and visual units can be noted. Figure 7 illustrates the range of preference mean ratings in example slides.

Examination of these calculations indicates that the river scenes were relatively more preferred over the marsh scenes. The lowest river preference rating (Bear River upper waterscape unit--2.90) is higher than the preference rating for the Central Marsh setting unit (2.47). The range of ratings between river units appears fairly limited (2.90 to 3.26), and the difference between ratings for river setting units is small (0.04).

The author's professional judgment of the factors contributing to the expression of preference in the slides representing the four river waterscape units and the single marsh setting unit will be discussed. This allows comparisons of trends, consistencies, and distinctions in the biophysical and visual factors affecting the expression of preference across visual units.

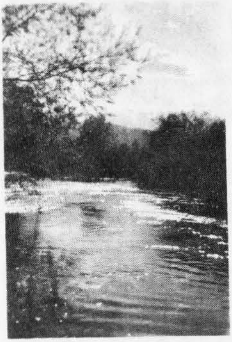
Respondents rated each slide according to their preference, which was defined as how much they liked the scene, or how pleasing they found it to be (Appendix B). As stated in Chapter Three, water may be considered a primary landscape feature of obvious survival importance to humans. For this reason, landscapes (or photographs of landscapes) that depict water are likely to be preferred. This effect has been minimized in this study

TABLE 5

PREFERENCE MEAN RATINGS FOR ALL RESPONDENTS PER VISUAL UNIT

Visual Unit	Mean Preference
Logan River Setting Unit	3.03
Logan River Upper Waterscape Unit	2.98
Logan River Lower Waterscape Unit	3.09
Bear River Setting Unit	3.08
Bear River Upper Waterscape Unit	2.90
Bear River Lower Waterscape Unit	3.26
Logan River and Bear River Combined	3.06
Central Marsh Setting Unit	2.47

All ratings based on a 5-point scale.



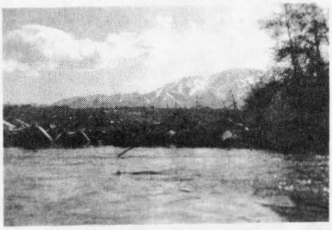
Slide #56 Rating: 4.6

Slide #26 Rating: 3.5

Slide #54 Rating: 3.0

Slide #18 Rating: 2.6

Slide #46 Rating: 1.9



Slide #32 Rating: 1.7

Figure 7. Representative range of preference mean ratings in slides.

by selecting slides which display water in relatively equal prominence; therefore, the biophysical and perceptual variables associated with water can be discussed in the context of expressed preference.

In the Logan River upper waterscape unit the mean preference for all the slides was 2.98. This is one of the lowest preference ratings for the four river units; however, the highest is only 3.26. There seem to be two major factors affecting the higher rated slides (five rated 3.2 to 4.6). Bends in the stream (see slide #19), multiple channels (see slide #26), and deep shadows at focal points (see slides #49 and #56) are apparent in these slides. These are biophysical attributes that contribute to the sense of mystery. Indeed, the judges' mean ratings for mystery in these five slides is 3.8. The second major factor is related to the diversity of elements, particularly vegetation height, density, and texture. Similarly, the judges' complexity mean rating for these five slides is 4.0. The remaining slides with lower preference mean ratings (1.7 to 2.5), also exhibit high mean ratings for mystery (4) and complexity (3.8), but there are some subtle and conspicuous differences. There are more long, straight reaches (see slides #8 and #34), less depth to the focal point (see slides #11 and #32), and, most importantly, trash on the riverbank (see slides #32 and #34) depicted in these scenes. A comparison of slide #32 (rated 1.7) and #56 (rated 4.6) reveals that the slide rated higher in preference was actually rated lower in coherence, complexity, and mystery and equally in legibility. The difference in the two slides is the visual dominance of abandoned automobiles and trash in the less preferred image. This trash appears to be the dominant factor in the lower preference rating.

The preference mean rating for the lower waterscape unit of the Logan River (3.09) is very similar to the rating for the upper waterscape unit. The factors affecting the preference ratings appear to be similar. The three highest rated slides (see slides #12, #45, and #29 rated 3.8, 3.2, and 4.0 respectively) exhibit a diversity of elements and textures as well as a sense of depth. When trash is apparent on the riverbank, the preference rating goes down accordingly (compare slide #29 rated 4 to slide #45 rated 3.2). It appears that images with an indistinct edge or those that are very deeply shadowed are less preferred (see slides #53 and #39). These factors relate directly to legibility and coherence.

The Bear River upper waterscape unit slides received a preference mean rating of 2.90 with a range from 2.2 to 3.8. The image with the highest rating displays what could be considered a harmonious blend of man and nature--farmhouse, barn and out buildings atop a high bank (see slide #1). This indicates that the <u>content</u> of man-made influences is very important to preference (trash and unkempt intrusions are disliked, orderly unions of settlements and landscape are preferred). Scenes displaying curving stream patterns were fairly well liked (see slides #14 and #43, each rated 3.1), as were those showing prominent and textured vegetation (see slides #41 and #60, rated 3.1 and 3.2 respectively). Less preferred views featured long, straight river corridors (see slides #2 and #51, rated 2.2 and 2.9 respectively), and human impacts that were prominent yet could not be classified as trashy or pastoral (see the bridge in slide #3, rated 2.3). A blocked view was also less preferred (see slide #27, rated 2.3).

The Bear River lower waterscape unit's preference mean rating was 3.255 (the highest of the river units) with a range of 2.2 to 3.9.

Again, the scenes with the best opportunity for involvement either in a two-dimensional sense (complexity) or a three-dimensional sense (mystery) seemed to be most preferred. This mystery effect is clearly seen in slides #30 and #40 which received preference ratings of 3.9 and 3.8. These slides also illustrate a diversity of elements and textures. The spaces in all the photographs are fairly well defined, yet the photographs rated above 3.0 in preference depict spaces that are more varied, undulating, and inviting in their ground plane outline (compare highly rated slides #36 and #30 to lower rated slides #25 and #38). The lower rated views showed little vegetative diversity and generally presented only one clearly defined space (see slides #9 and #18).

The images of the Central Marsh setting unit were definitely less preferred than the river scenes (mean rating of 2.47), although the range is quite broad (1.9 to 3.8). There appear to be a number of factors affecting the ratings. Views with foreground vegetation that could hide new information (mystery) were definitely preferred (see slides #13, #37, #44, and #55). These slides, along with #4 and #31, accentuate the perception of depth by portraying foreground textures that are medium or coarse that can be compared to middle and background textures that are seen as much finer. These images also display more detail such as background land use patterns and mountains (see slides #4 and #13) as well as reflections on the water of these and other elements that add to the visual interest (complexity) in the scenes (see slides #13, #31, and #55). Displays that were not as preferred often showed little depth or differentiation of space (see slides #20, #46, and #57) as well as little opportunity for involvement (see slides #15 and #24).

Human impacts were not well represented in the scenes; however, the three slides in which farmland patterns were visible were relatively preferred (see slides #4, #13, and #31, rated 2.5, 3.8, and 2.6 respectively).

In summary, preferred river scenes exhibited a number of biophysical and perceptual attributes. Scenes that were diverse and offered a sense of mystery and depth were well liked. The long, curving stream corridors and pastoral settings received high ratings. When the river bank was littered with trash, when the edge and spatial definition were unclear or too simple, ratings declined. Blocked views also received lower ratings. In the marsh, the most well-received images had a sense of depth and mystery. Foreground vegetation aided this effect as well as offering textural detail and richness. Strong reflections on the water (what could be termed "vividness") enhanced preference. Scenes that were not particularly preferred exhibited little depth or differentiation of space and little opportunity for involvement.

Part B of research question number two addresses the statistical validity in differences in preference ratings among visual units: Are the differences in expressed preference mean ratings between landscape types, setting units, and waterscape units statistically significant?

The preference variable was subjected to an analysis of variance using the mean ratings of all respondents on all slides for the marsh setting unit and river waterscape units as treatments. The F-test (when comparing groups of treatments) and the Least Significant Difference test (when comparing pairs of treatments within the groups) were used to determine which, if any, of the landscape types, setting units, or waterscape units were having a statistically significant effect in explaining the variance in the ratings of preference. A significant F-test or LSD test would indicate if the rating of mean preference was significantly different between any of the treatments or combinations of treatments.

As seen in Table 6, the F-test did indeed indicate significant differences in the preference ratings between treatments (visual units). This F-test value (F = 4.15 with 4,55 d.f.) is significant at the .005 level.

Mean comparisons using F-tests for linear contrasts were conducted to ascertain if the significant differences in the respondents' preference mean ratings were between the two river setting units, between each river setting unit and the marsh setting unit, and/or between both river setting units combined and the marsh setting unit. Tests of least significant difference were conducted on the waterscape units within each river setting unit.

Statistically significant differences in the ratings appeared when comparing the Logan River setting unit and the Bear River setting unit to the Central Marsh setting unit (F = 9.985 and F = 11.589 respectively) and when comparing all river units to the marsh (F = 139.200) (Table 7). These F values are all significant at the .005 level. The difference in the preference ratings between the Logan River setting unit and the Bear River setting unit (F = 0.0596) was not statistically significant. The differences between waterscape units within each river setting unit were also not statistically significant according to the LSD test.

In summary, there appear to be statistically significant differences (or explanations of variability) in the respondents' preference

TABLE 6

ANALYSIS OF VARIANCE--PREFERENCE

Source	df	Mean Square	F
Total	59		
Treatment	4	1.318282	4.153823*
Error	55	0.317366	

Treatment	Treatment Means
1 (Logan River Upper)	2.977
2 (Logan River Lower)	3.091
3 (Bear River Upper)	2.900
4 (Bear River Lower)	3.255
5 (Central Marsh)	2.471

*significant at .005 level

TABLE 7

F-TESTS AND LSD TESTS FOR PREFERENCE RATINGS BETWEEN VISUAL UNITS

F-tests	
Units Compared	F
Logan River Setting Unit to Bear River Setting Unit	0.0596
Logan River Setting Unit to Central Marsh Setting Unit	9.985*
Bear River Setting Unit to Central Marsh Setting Unit	11.589*
All Rivers to Marsh	139.200*

LSD Tests		
Units Compared	Difference	LSD
Logan River Upper to Logan River Lower	0.114	0.505
Bear River Upper to Bear River Lower	0.355	0.505

*significant at .005 level

mean ratings between rivers and marshes at the landscape type and setting unit scale. The difference in ratings between rivers are not significantly different at either the setting unit or waterscape unit scale. These statistical analyses support the general observations made from examining the data related to part A of this research question.

Part C of question two is: Do demographic variables (age, sex, home state, and academic major) and viewing sequence have any statistically significant effect on preference at the setting unit or waterscape unit scale or over all the slides?

Preference mean ratings for each respondent per visual unit were subjected to a step-wise multiple regression analysis to determine the potential effect of these variables on preference at each visual unit scale. Preference mean ratings for each respondent per visual unit are listed in the Appendix, Table 16. The preference respondents' demographic and viewing sequence categories are shown in Table 8. The results of the regression analysis can be found in Table 9. Although the relative importance of each demographic variable to the preference ratings varies from unit to unit, the percentage of variability in all preference ratings that can be explained by all five of the variables in combination never exceeds 32% (Logan River lower waterscape unit r-square = .318). In fact, over all the slides combined, only 30% of the variability can be explained by all five demographic variables. The implication here is that preference ratings remain relatively stable among respondents regardless of the respondent's individual

TABLE 8

PREFERENCE RESPONDENTS' DEMOGRAPHIC AND VIEWING SEQUENCE CATEGORIES

Category	Subcategory	Number of Respondents
Age in Years	18-25	86
	26-30	10
	31-40	2
Sex	Male	75
	Female	23
Home State	Western U.S.A.	6
	Intermountain U.S.A.	71
	Midwest U.S.A.	10
	Southern U.S.A.	1
	Northeast U.S.A.	9
	Foreign Country	1
Academic Major	Business	28
	Humanities	15
	Natural Resources	21
	Agriculture	9
	Science	7
	Engineering	7
	Design/Art	11
Viewing Sequence	In Sequence	39
	Reverse Order	59

TABLE 9

REGRESSION ANALYSIS OF PREFERENCE BY DEMOGRAPHIC

CATEGORIES AND VIEWING SEQUENCE

Logan River Setting Unit			
Upper Waterscape Unit		Lower Waterscape Unit	
Source	d.f.	Source	d.f.
Total	97	Total	97
(1) Viewing Sequence	1	(1) Viewing Sequence	1
(2) Age	2	(2) Age	2
(3) Sex	1	(3) Sex	1
(4) Home State	5	(4) Home State	5
(5) Academic Major	6	(5) Academic Major	6
Error	82	Error	82
R-squared = 0.204		R-squared = .318	
Subset 2 deleted		Subset 2 deleted	
Total	97	Total	97
(1) Viewing Sequence	1	(1) Viewing Sequence	1
(3) Sex	1	(3) Sex	1
(4) Home State	5	(4) Home State	5
(5) Academic Major	6	(5) Academic Major	6
Error	84	Error	84
R-squared = .195		R-squared = .305	
Subset 4 deleted		Subset 4 deleted	
Total	97	Total	97
(1) Viewing Sequence	1	(1) Viewing Sequence	1
(3) Sex	1	(3) Sex	1
(5) Academic Major	6	(5) Academic Major	6
Error	89	Error	89
R-squared = .151		R-squared = .240	
Subset 5 deleted		Subset 3 deleted	
Total	97	Total	97
(1) Viewing Sequence	1	(1) Viewing Sequence	1
(3) Sex	1	(5) Academic Major	6
Error	95	Error	90
R-squared = .067		R-squared = .223	
Subset 3 deleted		Subset 5 deleted	
Total	97	Total	97
(1) Viewing Sequence	1	(1) Viewing Sequence	1
Error	96	Error	96
R-squared = .0398		R-squared = .109	

TABLE 9 (continued)

Bear River Setting Unit			
Upper Waterscape Unit		Lower Waterscape Unit	
Source	d.f.	Source	d.f.
Total	97	Total	97
(1) Viewing Sequence	1	(1) Viewing Sequence	1
(2) Age	2	(2) Age	2
(3) Sex	1	(3) Sex	1
(4) Home State	5	(4) Home State	5
(5) Academic Major	6	(5) Academic Major	6
Error	82	Error	82
R-squared = .286		R-squared = .210	
Subset 2 deleted		Subset 2 deleted	
Total	97	Total	97
(1) Viewing Sequence	1	(1) Viewing Sequence	1
(3) Sex	1	(3) Sex	1
(4) Home State	5	(4) Home State	5
(5) Academic Major	6	(5) Academic Major	6
Error	84	Error	84
R-squared = .276		R-squared = .201	
Subset 4 deleted		Subset 5 deleted	
Total	97	Total	97
(1) Viewing Sequence	1	(1) Viewing Sequence	1
(3) Sex	1	(3) Sex	1
(5) Academic Major	6	(4) Home State	5
Error	89	Error	90
R-squared = .203		R-squared = .152	
Subset 3 deleted		Subset 1 deleted	
Total	97	Total	97
(1) Viewing Sequence	1	(3) Sex	1
(5) Academic Major	6	(4) Home State	5
Error	90	Error	91
R-squared = .190		R-squared = .144	
Subset 5 deleted		Subset 4 deleted	
Total	97	Total	97
(1) Viewing Sequence	1	(3) Sex	1
Error	96	Error	96
R-squared = .099		R-squared = .0274	

TABLE 9 (continued)

Central Marsh Setting Unit	
Source	d.f.
Total	97
(1) Viewing Sequence	1
(2) Age	2
(3) Sex	1
(4) Home State	5
(5) Academic Major	6
Error	82
R-squared = .206	
Subset 4 deleted	
Total	97
(1) Viewing Sequence	1
(2) Age	2
(3) Sex	1
(5) Academic Major	6
Error	87
R-squared = .155	
Subset 3 deleted	
Total	97
(1) Viewing Sequence	1
(2) Age	2
(5) Academic Major	6
Error	88
R-squared = .150	
Subset 2 deleted	
Total	97
(1) Viewing Sequence	1
(5) Academic Major	6
Error	90
R-squared = .124	
Subset 1 deleted	
Total	97
(5) Academic Major	6
Error	91
R-squared = .0976	

All Units Combined	
Source	d.f.
Total	97
(1) Viewing Sequence	1
(2) Age	2
(3) Sex	1
(4) Home State	5
(5) Academic Major	6
Error	82
R-squared = .302	
Subset 2 deleted	
Total	97
(1) Viewing Sequence	1
(3) Sex	1
(4) Home State	5
(5) Academic Major	6
Error	84
R-squared = .298	
Subset 5 deleted	
Total	97
(1) Viewing Sequence	1
(3) Sex	1
(4) Home State	5
Error	90
R-squared = .194	
Subset 3 deleted	
Total	97
(1) Viewing Sequence	1
(4) Home State	5
Error	91
R-squared = .165	
Subset 4 deleted	
Total	97
(1) Viewing Sequence	1
Error	96
R-squared = .0511	

age, sex, home state, or academic major, at least in the categories represented by the preference respondents in this study.

Research question number three part A: Are there significant correlations between pairs of perceptual variables (based on judges' ratings) or between individual perceptual variables and preference (based on mean preference as expressed by respondents) over all the slides or at the landscape type, setting unit, or waterscape unit scale; in other words, which perceptual variables are strongly related to preference and to one another?

Correlation matrices were developed incorporating the mean judges' ratings of the perceptual variables and mean preference ratings of all respondents over all the slides and at each visual unit scale. From these matrices meaningful correlations can be noted. It can be determined if these correlations extend across landscape types, setting units, or waterscape units, and trends or consistencies based on these observations can be identified. These correlation matrices results are presented in Table 10, which allows quick comparisons between values across visual units and landscape types.

It should be noted that in this type of study, significant correlation values are generally the exception, not the rule, especially for the four perceptual variables related to preference. To the extent that each of the perceptual variables is expected to be important in some degree to preference (not to mention other potential variables that are not a part of this study), this is a reasonable guideline. In cases where a single perceptual variable correlation to preference is high (as happens in one instance in this study), this relationship should be viewed with caution. It indicates that perhaps the judges were rating the slides not for the perceptual variable selected, but for how much they liked the scene,

TABLE 10

CORRELATION VALUES OF PERCEPTUAL VARIABLES AND PREFERENCE PER VISUAL UNIT

	LR-U	LR-L	LR	BR-U	BR-L	BR	R	CM	AU
Coherence-Complexity	-.27	.06	-.11	-.25	-.21	-.33	-.29	-.75*	-.51*
Coherence-Mystery	-.21	-.19	-.17	-.20	-.56	-.20	-.18	.00	-.41*
Coherence-Legibility	-.28	-.21	.03	.12	.15	.26	.14	.14	-.01
Complexity-Mystery	.10	.43	.22	.00	-.24	-.22	.00	.03	.15
Complexity-Legibility	-.65*	-.21	-.45*	.06	-.30	-.21	-.32*	-.42	-.27*
Mystery-Legibility	-.34	.23	-.10	-.36	-.32	-.22	-.15	.25	.10
Coherence-Preference	-.16	.37	.01	.03	-.61	-.09	-.02	-.44*	-.33*
Complexity-Preference	.10	.60	.20	.84*	.51	.50*	.32*	.31	.37*
Mystery-Preference	-.02	.43	.08	-.25	.28	.18	.12	.50*	.41*
Legibility-Preference	-.43	-.15	-.31	.20	-.34	.00	-.19	.12	.00

Key: LR-U = Logan River Upper Waterscape Unit
LR-L = Logan River Lower Waterscape Unit
LR = Logan River Setting Unit
BR-U = Bear River Upper Waterscape Unit
BR-L = Bear River Lower Waterscape Unit
BR = Bear River Setting Unit
R = All River Units
CM = Central Marsh Setting Unit
AU = All Units (River and Marsh)

*Significant at .05 level.

hence the strong correlation would actually be of judges' preference to respondents' preference. This type of correlation would, of course, be expected to be high.

The majority of the correlation values between the pairs of perceptual variables and for each perceptual variable to preference are not statistically significant (see Table 10). These results are useful because they indicate that each perceptual variable is an independent predictor, particularly as expressed at the waterscape unit and setting unit scales of analysis. When correlation values are calculated for all 60 slides combined, a majority of the statistically significant values emerge. These results will be discussed for the relationships of the pairs of perceptual variables and for each perceptual variable to preference.

Three pairs of perceptual variables are significantly correlated when all of the slides are considered. Coherence and complexity are negatively related ($r = -.51$). This relationship explains 26% of the variance between the two variables, and is influenced by the Central Marsh setting unit ($r = -.75$). The most coherent marsh scenes depicted regular vegetation with horizontal organization, whereas complex scenes portrayed more depth and visual access to background mountains, land uses, and vegetation. Coherence and mystery are also negatively correlated for all 60 slides ($r = -.41$), a value which explains 17% of the variance between the two perceptual variables. There are no significant correlation values for this pair at any other scale of analysis, making it very difficult to comment on this relationship. Complexity and legibility are negatively correlated, having an $r = -.27$, which explains only 7% of the variance between the two. Statistically significant values do occur for this pair for one of each of the three scales of analysis of river scenes (waterscape unit, setting unit, and landscape type). The most legible scenes in those units were of straight corridors bounded by similar vegetation, whereas complex scenes often showed a diversity of vegetation and spatial organization.

Over all 60 slides, three of the perceptual variables are significantly correlated to preference--coherence (r = -.33 or 11%), complexity (r = .37 or 14%), and mystery (r = .41 or 17%). The relationship of both coherence to preference and mystery to preference are strongly influenced by the marsh values (r = -.44 and r = .50 respectively). A highly coherent marsh scene was often visually simple and monotonous, hence the previously discussed negative relationship of coherence to complexity, and the negative relationship of coherence to preference. Marsh scenes seldom expressed high levels of mystery; however, when mystery was present the opportunity for involvement and gaining new information from a relatively monotone landscape was appreciated by the viewer. The significant correlation of complexity to preference (r = .37 or 14%) over all the slides is expressed at one of each of the three scales of analysis, particularly in the Bear River scenes (lower waterscape unit r = .84, setting unit r = .50). These higher values support the hypothesis of visual diversity as an important predicter of preference. The correlation value for legibility to preference (r = .00) may be the result of positive and negative values counteracting one another; it is not possible to draw any reasonble conclusions based on these results.

In summary, the results of the correlation matrix developed for each of the perceptual variables indicates that these are relatively independent of each other. Over all 60 slides, three of the pairs of perceptual variables were significantly correlated; however, they explained only 7% to 26% of the variance between the pairs. The most significant value (r = -.51), for coherence to complexity, was influenced strongly by the marsh scenes (r = -.75). Three of the perceptual variables were significantly correlated to preference (coherence, complexity, and mystery), with 11% to 17% of the variance between the pairs explained. The marsh scenes were most influential on the relationships of coherence and mystery to preference, while river scenes affected the significant correlation of complexity to preference.

Part B of research question number three is: Do perceptual variables or visual units explain a more significant amount of the variability in preference mean ratings; in other words, which of the two are more strongly related to preference?

Preference mean ratings across all the slides were subjected to a regression analysis using the perceptual variables and visual units as analysis variables. The F-test was used for each subset of variables (perceptual vs. units) to determine if one subset explained a significant amount of the variability in mean preference over and above that explained by the other, and hence would indicate one subset was more strongly related to preference than the other.

The results of this regression analysis are displayed in Table 11. Subset number one represents the visual units' relationship to preference. Subset number two represents the combined effect of each of the perceptual variables on preference. The F-value

TABLE 11

REGRESSION ANALYSIS OF PREFERENCE BY PERCEPTUAL VARIABLES

AND BY VISUAL UNITS

Source	d.f.	Mean Square	F-Ratio
Total	59	0.385	
Subset 1 (visual units)	4	0.5212285	1.826730
Subset 2 (perceptual variables)	4	0.7257717	2.543585*
Model	8	1.022	r-squared = 0.360
Error	51	0.285	

*significant at .05 level

for the visual units subset is 1.82673, while the F value for the perceptual variable is 2.543585. With 4,51 degrees of freedom, the F value for the visual units is not statistically significant. However, with the same 4,51 degrees of freedom the F value for the perceptual variables is essentially significant at the .05 level. It would appear from this analysis that the perceptual variables explain a significant amount of the variability in mean preference over and above the variability explained by the visual units, and therefore, it appears that when compared to visual units, perceptual variables are more strongly related to preference.

Summary

This chapter has presented the data gathered, analysis procedures implemented, and results obtained. These results indicate that there appear to be professionally judged and statistically significant differences in the expression and importance of the four perceptual variables tested (particularly coherence and mystery) between visual units at the landscape type and setting unit scale, and to a limited degree at the waterscape unit scale. The expression of coherence in rivers is dependent upon similarities in vegetation and edge definition and a sense of orderliness. Coherence in the marsh environment is expressed by similarities in vegetation and horizontal organization of biophysical elements. The expression of complexity in rivers is primarily a function of vegetation diversity along with a variety of other elements such as land use patterns, trash, and background features. Marsh complexity is expressed most strongly when differences in vegetation textures from foreground to background are evident. The expression of mystery in rivers is related to obscuring foliage, the bend in the river, and the prominence of the riverbank. Mystery in the marsh is directly related to the presence of obscuring foreground vegetation. River legibility is a function of straight, enclosed corridors, fine textures, and a regular, continuous edge, while marshes are legible when simple spaces bordered by regular vegetation are expressed.

There also seem to be professionally judged and statistically significant differences in preference ratings between rivers and marshes at the landscape type and setting unit scales but differences are not as meaningful between rivers at either of the two scales tested. Preferred river scenes were biophysically diverse and high in mystery and visual depth. Pastoral settings and curving stream corridors were liked, as opposed to trash, unclear spatial definition, and blocked views. Marsh images that expressed mystery and depth were preferred, especially those with foreground vegetation and vivid reflections on the water. Preference ratings are not significantly influenced by the combined effect of the demographic variables of age, sex, home state, and academic major as expressed by respondents in this study.

The correlation matrix developed for each pair of perceptual variables affirms that each variable is an independent predictor. Over all the slides, three of the pairs were significantly correlated; the strongest value was for coherence to complexity. Three perceptual variables were significantly correlated to preference--

complexity, mystery, and coherence--with river scenes affecting complexity as a predictor of preference and marsh scenes affecting mystery and coherence as predictors of preference.

Finally, from the results of the regression analysis of preference, when compared to visual units, perceptual variables exhibit a statistically stronger relationship to preference.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Introduction

> Landscape is a kind of backcloth to the whole stage of human activity. Consequently we find it entering into the experience of many kinds of observers as it is encountered in many kinds of context. For some the chief interest lies in the explanation and interpretation of the landscape itself, natural or man-made; for others in the way we look at it. For some it is more meaningful when perceived through the medium of painting; for others it must be experienced directly. For some it is a proper subject for scientific study; for others it belongs to the arts and this, perhaps, has proved one of the most difficult stumbling-blocks of all. (Appleton, 1975, p. 2)

The goal of this research has been to explore the differences in human perception of landscape, particularly as related to rivers and wetlands. Previously identified landscape assessment concepts from the qualitative descriptive inventory approach and from the theoretically-based empirical perceptual preference approach were applied to a site composed of river and wetland landscapes. The purpose of this chapter is to summarize and evaluate the objectives, methods, and results presented in this study. The limitations and implications of the major findings will be discussed, as will areas for further research.

The objectives of this study were framed as research questions to be addressed. These questions were intended to investigate: (1) the expression and relationship of perceptual variables to visual units; (2) the expression and relationship of visual units to preference; (3) the effect of demographic variables on preference; (4) the relationship of perceptual variables to preference; and (5) the relative strengths of perceptual variables and of visual units to preference. These objectives were addressed by comparing two well-documented and precedented methodologies. The data gathered and results obtained were analysed by professional judgment and accepted statistical procedures. These procedures and results will be discussed in the following sections.

Evaluation of Methodology

As stated in Chapters Two and Three, this research followed closely the methodologies of R. Burton Litton, Jr. and of Stephen and Rachel Kaplan. Although the majority of the work in classifying and delineating biophysically based visual units was part of an earlier study by the author (Ellsworth, 1980), some comments on the methodology as it relates to the findings in this study are relevant. The techniques employed in gathering the data used to define the visual units (field visits, map interpretation, photograph interpretation, and professional judgment of the principal researcher) seem to have been appropriate and effective. Confidence in the decisions made regarding how to collect the data was felt by the researcher. The delineation of landscape and setting units seems quite reasonable; however, the results of the present study suggest that the definition and distinction of waterscape units, either specifically in this study or generically in the concept of this scale of visual unit, are suspect. Although the author believed the designation of waterscape units to be valid throughout the research conducted during both studies, statistical analyses reported here do not consistently support these designations.

The selection of photographs was an exciting, enlightening, and frustrating task. The establishment of guiding criteria (discussed in

Chapter Three) helped immensely. One cannot hope to represent all possible combinations of variables to be investigated, realizing that judges and preference respondents are receptive to and effective within only fairly narrow limits of total numbers of slides that can be viewed and decisions that can be made. The process of selecting more slides for the judges to rank (76) than would be used in the final preference judgments (60), allowing the selection of those slides best representative of the range of variables to be tested, worked quite well. For the researcher to pre-select the exact slides limits his flexibility during the process and potentially casts a shadow on the empirical validity of the results.

The author's selection, training, and interaction with the judges of the perceptual variables was one of the most personally satisfying aspects of this study. The student judges were, for the most part, extremely interested and diligent in their ratings of the concepts. Questions and discussion were the rule rather than the exception. The author feels that this cooperation and interaction was pivotal in assuring the consistency of the ratings. Even though the high ratings in one waterscape unit for one variable indicate that there may have been some confusion about rating for the variable or for preference, the fact that this was manifested in only one set of 10 slides when a total of 60 slides were viewed by 18 judges and rated for four different perceptual variables attests to the overall success of the judging exercise.

The validity of the use of students as preference respondents has been discussed earlier (Chapter Three). The students who participated in this study were quite well suited for addressing the stated objectives. They were receptive and represented a diversity of demographic characteristics. Just as important, there were sufficient numbers in the class selected so that the entire sampling procedure took less than 45 minutes. Since preference is a decision that people make daily, the instructions and purpose of the exercise were easily communicated and followed. This phase of the research went so smoothly it is difficult to make any recommendations for improvements.

The evaluation of the results incorporated two techniques--professional evaluation by the author and statistical analysis with the aid of the faculty of the Departments of Applied Statistics and Computer Science at Utah State University. The author's interpretation of the expression of the perceptual variables as rated in individual slides was made much easier due to the spirited discussions of the judges as they rated them. Even though some months lapsed between the judging sessions and the author's evaluations, recollections of the comments made by the judges were very helpful. The author's familiarity with the study site from many hours of research and recreation was critical. Extensive note-taking during the judging sessions, or perhaps tape recording the sessions, would no doubt have made the evaluation process easier and more thorough.

The statistical analyses would not have been possible without the hospitality of the faculty members consulted from the Applied Statistics and Computer Science Departments. The procedure used by the author was to frame research questions and allow the faculty members to suggest appropriate statistical procedures. Many analyses were conducted that have not been reported here because they did not answer the objective of the question, even though the results were often interesting and thought-provoking. This question and answer procedure worked quite well, encouraging the explicit wording of the questions in order to precisely define the analysis desired.

Major Findings

Limitations. This research is related in many ways to other visual assessment studies, particularly those done by Litton, Kaplans, and their colleagues. At the same time, there are unique aspects of the methods and results reported here that suggest caution in generalizing beyond certain reasonable limits.

The mean values obtained for the expression of the perceptual variables and for preference are generally moderate to high and are relative to one another as expressed in this study. Direct comparisons to other studies or environments--even those that were evaluated on a similar 5 point scale--could be misleading. For example, high ratings of complexity and mystery and the apparent correlation of these variables to preference as found in this study, may not be directly comparable to other studies where similar or dissimilar results were obtained. The levels of these variables found here may be relatively moderate in comparison to a complex urban environment or even to a similar natural environment where more diversity in land form or vegetation is expressed or where a stream exhibits fast water or multiple meanders that might heighten the overall expression of mystery.

This research used a specific test site that is not typical of all those environments that could be termed "rivers" or "marshes" or "wetlands". The Cutler Reservoir, Logan River, and Bear River exhibit biophysical features that are to be found in many such environments in the Intermountain West. Generalizing the results to similar lands in this geographic region is reasonable, but to call directly on the conclusions of this study to describe or assess the visual resources of wetlands in, for example, eastern or southern North America would have to be done with great caution.

Familiarity of the judges or the preference respondents with the environments researched has not been addressed. The effect of familiarity has been the subject of a number of studies--however, this effect is not as yet clearly defined (R. Kaplan, 1977b; Hammitt, 1978; Herzog, Kaplan and Kaplan, 1976; Kaplan and Kaplan, 1977). The author believes that the numbers and diversity of demographic characteristics of the preference respondents has helped to offset the potential biases that may have been expressed by those respondents who engage in hunting, bird watching, canoeing, or similar activities directly related to the environments displayed.

Finally, as mentioned in Chapter Two, the author's extensive literature search revealed no studies that dealt with wetlands as they exist in the intermountain area. Studies have been done on bogs (Hammitt, 1978) and on wetlands in Massachussetts (Smardon, 1975), but neither of these environments could be said to be biophysically similar to the wetland type studied here. This research may at once be viewed as pioneering and therefore significant, but at the same time the results need to be tempered with the results of studies yet to be done on similar environments.

Conclusions and discussion. A great deal of data has been generated and analyzed in a variety of ways in this project. The results have been discussed at length in the preceding chapter. The author's interpretation and discussion of what he considers the major findings of this research will be presented here.

Investigating the expression and importance of the perceptual variables of coherence, complexity, mystery, and legibility in rivers and marshes was a major objective of this research. The differences in the expression of these variables between rivers and marshes, a body of information that speaks to the previously cited lack of research accomplished on wetlands of this type, is significant. Both rivers and marshes were considered coherent when there were similarities in vegetation qualities within the respective types; however, the strong horizontal organization of the marsh scenes necessary for coherence contrasts dramatically with the edge definition and orderliness considered necessary in rivers. Mystery was also related to similar factors in rivers and marshes (such as obscuring vegetation, particularly in the marsh) but the presence of riverbanks and bends in the river corridor had a distinct, noticeably different effect on mystery ratings in the rivers (cf. R. Kaplan, 1977a). The statistical analysis, which identified meaningful differences in judges' ratings of mystery between the two landscape types, seems to corroborate these findings.

Complexity in both rivers and marshes was primarily dependent on diversity of vegetation and the presence of visual depth, but the number of different elements in river scenes also influenced complexity. Legibility was analyzed as related to the similar concepts of straight, enclosed and simple corridors in river images and simple spaces with regular vegetation in marsh images. The effect of fine textures was more evident in rivers than in marshes, but was not as strong an influence as clear spatial definition. Again, the statistical analyses seem to support these observed differences.

Preference for both rivers and marshes appeared to be especially dependent on mystery and complexity. It is important to note that these concepts are both "involvement" components of Kaplans' framework, as opposed to the "making sense" components of coherence and legibility. The implication is that this aspect of the information processed by the observer may be more important to preference, however, more research is needed. Mystery and complexity have been found to be important to preference in other studies (S. Kaplan, 1975; R. Kaplan, 1979b), although the relationship of complexity and preference was interpreted as more important in the present study.

A sense of visual depth was also important to preference in both rivers and marshes. This concept, related to legibility, may be termed "spaciousness" and as such has appeared as an important factor in preference in other studies (R. Kaplan, 1977b). The clearer the definition of space, the more likely preference ratings will be high. The clarity of the vegetation-water edge was also important to preference and has been reported in other studies (R. Kaplan, 1977a; Litton, et al., 1974), as was the importance of the presence of fine textures, especially in rivers (S. Kaplan, 1975). Finally, the negative effect of trash on preference, although not unexpected, is supported here by empirical evidence.

The clearly observed and statistically validated distinct differences in preference for river scenes over marsh scenes is very meaningful, especially in light of the modern day development decisions that often affect these lands. However, it should be emphasized that these relative differences in preferences between the two landscape types in no way suggests that marsh landscape types are visually deficient or aesthetically inferior. The expressed preferences for marshes must be compared to the preferences for the alternative environments that would take their place, not to other landscape types that may or may not be geographically associated with them.

Demographic diversity in age, sex, home state (which relates to regional or cultural differences), and academic major (related to biases developed from professional and vocational training) has been shown in this study to be relatively insignificant to preference judgments. Similar observations have been noted in other research (Daniel and Boster, 1976; Zube, Pitt, and Anderson, 1975). This is significant in its relationship to Kaplan's theory of information-processing and the evolutionary survival importance of preference decisions (see Chapter Two). The results of this study lend support to the theory that preference judgments are not idiosyncratic or whimsical, but that a good deal of regularity in preference is expressed across diverse groups and individuals.

The importance of the perceptual variables to preference and to one another (as seen in the correlation values of research question III) are in agreement with similar findings summarized by S. Kaplan (1975). The effects of significant correlations found within rivers and marshes upon the significant correlations calculated over all the slides are reasonable in view of the biophysical expression of these variables, and illustrate the autonomy of each predictor.

Finally, the indication that perceptual variables are more strongly related to preference than are visual units is very significant. The literature search revealed no studies that had addressed this relationship, although the study of the land use categories by R. Kaplan (1977b) discussed in Chapter Two is similar. The implication of the findings here is that determinations of preference are not as strongly related to biophysical aspects of the environment as some researchers have suggested (Shafer, Hamilton, and Schmidt, 1969; Shafer and Mietz, 1970). The validity and utility of descriptive inventories in visual assessment is in no way denigrated by this statement. It is suggested, however, that to assume levels of landscape preference based on biophysical inventories may not be a reliable procedure.

Management implications. The landscape types investigated in this study are not unique. There are many similar environments in the Intermountain West. The U.S. Fish and Wildlife Service manages many acres of public lands where management plans could benefit from the results of this study. These areas include Gray's Lake National Wildlife Refuge, Bear River National Wildlife Refuge, and Bear Lake National Wildlife Refuge. In addition, there are many state controlled as well as suburban lands where concerns for waterfowl habitat, water purity, wetlands preservation, and environmental quality and diversity are major concerns (see Palmer and Zube, 1976). The results of this project can aid managers of these lands in addressing the visual resource.

In addition, designers and resource managers often seek to inform the public about the resources of the lands under their control through a variety of methods. The control of perceptual influences, particularly mystery and legibility, is very much in the hands of the skillful designer (Hammitt,1978, 1980a, 1980b). Interpretive trails and vegetative management can be designed so as to emphasize those perceptual variables considered important to the education and enjoyment of the visitor. Similarly, decisions on road alignments, development, and the control of trash can be incorporated into management plans where consideration is given to visual concerns.

Further Research

The relationship of the qualitative descriptive inventory and theoretically-based empirical perceptual preference approaches to visual assessment has been investigated in this study. There are many areas of related study open to investigation. The relationship of the evaluative design concepts of unity, variety, and vividness to perceptual variables should be studied, as should the link between perceptual variables and the aspects of form, line, color, and texture as used in the visual management programs of the U.S. Forest Service and Bureau of Land Management. The salience of professionally evaluated visual units in the perceptions of lay people can be explored by Q-sort methods (Pitt and Zube, 1979) and by sophisticated dimensional analyses (R. Kaplan, 1974, 1975; S. Kaplan, 1979).

Research into similar landscape types to those investigated here is encouraged. The lands within the national wildlife refuge system mentioned earlier would be excellent case study sites. Research on landscape types that exhibit similar visual characteristics to marshes yet express those characteristics in different biophysical aspects (e.g., prairies, plains, deserts, and flat farmlands) may reveal the unique visual characteristics of each landscape type. Studies of landscape visual units of more pronounced biophysical differences would supplement the conclusions drawn in the current study regarding the perceived differences between scales of units. Clarification of apparent relationships of perceptual variables to such units and to preference would be very useful.

Studies of the effect of familiarity on preference ratings where the relationship between diverse landscape types is being investigated, are urgently needed. Wetland landscapes are often considered waste lands by the general public, possessing little social, economic, or ecologic value. The influence on preference of education about these lands and of familiarity with them needs to be researched. Seasonal and ephemeral influences on the delineation of visual units, on the perception of variables such as coherence, complexity, mystery, and legibility, and on preference have not been adequately addressed in the literature. The importance of other primary landscape features (paths, trees, etc.) and of fauna is not well understood. Finally, the identification and expression of other perceptual-behavioral influences on preference, such as the concepts of prospect and refuge (Appleton, 1975) should be researched.

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APPENDICES

Appendix A

Tables

TABLE 12

STUDY SLIDES' NUMBERS AND VISUAL UNITS REPRESENTED

Slide #	Visual Unit	Slide #	Visual Unit	Slide #	Visual Unit
1	BR-U	21	BR-L	41	BR-U
2	BR-U	22	LR-L	42	CM
3	BR-U	23	CM	43	BR-U
4	CM	24	CM	44	CM
5	CM	25	BR-L	45	LR-L
6	BR-L	26	LR-U	46	CM
7	LR-L	27	BR-U	47	LR-L
8	LR-U	28	CM	48	CM
9	BR-L	29	LR-L	49	LR-U
10	LR-U	30	BR-L	50	CM
11	LR-U	31	CM	51	BR-U
12	LR-L	32	LR-U	52	CM
13	CM	33	LR-U	53	LR-L
14	BR-U	34	LR-U	54	BR-U
15	CM	35	LR-L	55	CM
16	CM	36	BR-L	56	LR-U
17	BR-L	37	CM	57	CM
18	BR-L	38	BR-L	58	CM
19	LR-U	39	LR-L	59	LR-L
20	CM	40	BR-L	60	BR-U

Key: LR-U = Logan River Upper Waterscape Unit
LR-L = Logan River Lower Waterscape Unit
BR-U = Bear River Upper Waterscape Unit
BR-L = Bear River Lower Waterscape Unit
CM = Central Marsh Setting Unit

TABLE 13

PRESENCE OF BIOPHYSICAL FACTORS IN STUDY SLIDES' VISUAL UNITS MATRIX

Visual Units	Biophysical Factor	Slide Number/Expression										Total Expressions
Logan River Setting Unit		8	34	56	32	10	49	19	26	33	11	
Upper Waterscape Unit	Stream Expression	x	x	x	x	x	x	x	x	x	x	10
	Continuous Edge	x	x	x	x	x	x	x			x	8
	High Vegetation	x	x	x	x	x	x	x	x	x	x	10
	Trash		x		x							2
	Other*				Ag							1
		7	22	29	39	53	47	45	35	12	59	
Lower Waterscape Unit	Stream Expression	x	x		x	x	x	x	x	x	x	9
	Continuous Edge		x		x		x	x	x	x	x	7
	Low/Med. Veg.	x	x	x	x		x	x	x	x	x	9
	Trash							x				1
	Other*	HV	Ag	U	Ag	HV		U	Ag	Ag		8
Bear River Setting Unit		3	2	51	54	60	1	14	43	41	27	
Upper Waterscape Unit	Stream Expression	x	x	x	x	x	x	x	x	x	x	10
	Continuous Edge	x	x	x	x		x	x	x	x	x	9
	High Vegetation	x	x	x	x	x		x	x	x	x	9
	Structures/Util.	x		x	x	x	x				x	6
	Other*		MV	Ag			Ag					3

*"Other" Key: Ag = Agriculture
HV = High Vegetation
MV = Medium Vegetation
T = Trees
U = Urban (small town)

TABLE 13 (continued)

Visual Units	Biophysical Factor	Slide Number/Expression										Total Expressions
Bear River Setting Unit		9	6	17	21	25	36	38	40	18	30	
Lower Waterscape Unit	Stream Expression		x	x	x	x		x	x	x	x	8
	Continuous Edge	x	x	x	x			x		x	x	7
	Med/Low Veg.	x	x	x	x	x	x	x	x	x	x	10
	Human Use/Impact											0
Central Marsh Setting Unit		58	57	31	37	42	44	46	48	50	52	
	Marsh Expression			x	x	x	x		x	x	x	
	Discontinuous Edge			x	x	x	x		x	x	x	
	Medium Vegetation	x	x	x	x	x	x	x	x	x	x	
	Agriculture			*Tx			*T					
		55	5	13	15	16	20	4	28	24	23	
	Marsh Expression	x	x	x	x	x	x	x	x	x	x	17
	Discontinuous Edge	x	x	x	x	x	x	x	x	x	x	17
	Medium Vegetation	x	x	x	x	x	x	x	x	x	x	20
	Agriculture			*Tx		*T		*Tx	x			9

*"Other" Key: T = Trees

TABLE 14

JUDGES' MEAN RATINGS OF PERCEPTUAL VARIABLES PER SLIDE

(rounded to nearest whole number)

Slide #	Coherence	Complexity	Mystery	Legibility
1	3	5	3	3
2	4	2	3	4
3	3	3	4	1
4	4	5	2	1
5	5	4	3	3
6	4	2	5	4
7	3	4	3	2
8	3	3	5	4
9	5	4	2	4
10	5	3	2	4
11	3	3	4	3
12	4	4	5	4
13	3	5	4	4
14	3	4	4	4
15	5	3	2	3
16	5	3	2	2
17	5	2	3	4
18	4	3	4	4
19	3	5	4	2
20	5	2	2	3
21	3	3	4	4
22	4	3	3	4
23	4	3	2	3
24	5	2	2	3
25	4	5	4	2
26	3	5	4	1
27	3	3	4	3
28	4	4	2	2
29	3	4	4	2

TABLE 14 (continued)

Slide #	Coherence	Complexity	Mystery	Legibility
30	4	4	4	5
31	3	5	1	2
32	4	5	5	3
33	4	4	4	3
34	3	4	2	5
35	3	4	4	4
36	4	3	4	3
37	5	3	2	3
38	5	2	4	4
39	2	3	4	4
40	4	3	5	2
41	4	4	4	3
42	5	3	4	3
43	4	4	4	3
44	4	3	4	3
45	4	4	3	3
46	5	3	2	4
47	3	4	4	3
48	5	2	3	3
49	4	3	5	4
50	5	2	2	3
51	3	4	3	4
52	5	3	3	2
53	4	3	3	1
54	4	4	3	3
55	5	3	3	2
56	3	4	4	3
57	5	1	2	4
58	5	2	3	3
59	3	3	3	5
60	4	3	3	3

TABLE 15

INDIVIDUAL RESPONDENTS' PREFERENCE RATINGS PER SLIDE

Respondent	Slide																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	3	2	2	3	3	4	5	4	3	4	3	4	4	3	2	2	2	1	3	2	3	1	1	2	2	5	3	2	3	3
2	3	1	3	1	1	2	3	2	2	2	1	3	3	2	2	2	3	2	2	2	3	1	1	2	3	3	2	2	4	3
3	5	2	3	2	2	1	4	2	3	2	2	4	5	3	2	2	3	2	5	1	3	5	2	3	3	4	1	3	5	3
4	4	5	2	3	2	4	5	3	3	5	5	5	3	3	2	3	4	1	5	2	5	2	4	4	5	5	2	3	5	5
5	4	2	3	2	2	4	5	4	4	5	5	4	5	5	4	4	4	5	3	2	2	4	1	2	3	4	3	2	4	5
6	5	2	2	3	3	3	5	2	3	4	3	5	3	4	2	2	4	2	5	1	4	3	1	2	3	4	2	1	5	3
7	3	2	3	2	4	5	1	3	2	4	3	3	4	5	2	2	2	2	3	1	2	3	1	4	2	2	3	1	1	4
8	5	2	3	2	3	4	1	2	2	3	1	3	5	2	4	4	3	1	5	2	4	3	2	2	1	5	5	2	4	2
9	5	4	2	4	4	5	5	4	4	5	4	5	5	4	3	3	4	3	4	3	5	5	3	3	3	4	5	2	4	3
10	5	3	3	4	4	5	5	3	3	2	2	3	3	3	2	2	3	4	4	3	3	2	3	3	4	4	2	3	4	4
11	5	3	3	4	1	3	4	2	3	4	2	3	3	2	2	2	3	3	4	3	4	4	3	1	3	4	2	2	5	4
12	5	4	4	3	3	4	5	2	4	3	1	5	5	4	2	2	4	3	4	2	5	5	3	3	3	4	4	2	5	5
13	3	2	3	4	2	3	5	3	2	4	3	5	4	4	3	3	4	2	5	2	3	3	1	3	3	5	2	3	5	4
14	4	1	1	1	2	2	3	2	2	3	1	2	2	2	2	2	3	1	2	1	2	1	1	2	1	2	1	1	2	3
15	3	2	4	3	2	5	5	4	3	5	2	4	2	4	3	2	4	3	5	3	4	4	1	2	3	4	3	2	3	5
16	3	2	1	2	2	3	4	2	3	4	2	5	5	3	2	2	2	3	2	2	3	3	2	1	3	2	3	4	3	2
17	3	3	2	2	2	2	3	3	2	3	4	3	3	2	1	1	2	1	4	2	1	4	3	5	4	3	3	5	3	5
18	5	3	2	3	3	2	4	4	3	4	2	5	5	5	4	3	4	2	5	3	5	4	2	2	3	5	2	2	5	3
19	2	3	2	3	3	3	5	3	2	4	4	4	4	5	3	3	4	2	5	3	5	3	3	5	1	5	3	4	5	2
20	5	2	5	3	4	4	3	1	2	3	3	3	5	3	3	2	4	3	5	1	5	4	3	2	4	5	3	3	5	4
21	3	4	2	5	5	4	5	4	3	3	3	5	5	5	5	4	5	3	5	4	4	3	3	4	3	5	2	3	5	3
22	3	4	2	2	2	3	5	4	2	4	3	3	2	3	2	2	2	3	4	1	2	3	2	2	1	5	3	2	3	4
23	3	3	2	2	2	5	5	3	4	5	4	4	2	3	2	1	3	3	5	1	4	3	1	1	1	5	2	1	3	3
24	5	3	3	4	4	4	4	2	3	3	2	4	3	3	4	4	4	3	5	3	4	4	3	3	4	5	4	3	5	4
25	4	3	2	4	3	3	4	3	4	4	2	4	4	2	3	3	4	2	5	3	3	4	2	3	4	5	3	3	5	3
26	5	1	2	3	3	3	2	1	3	2	1	3	4	3	3	3	2	1	3	2	3	1	1	2	3	4	2	3	5	4
27	4	2	3	2	4	5	4	2	2	3	1	2	4	3	2	2	4	3	5	1	4	5	2	2	2	5	3	2	4	5
28	5	2	3	4	2	3	4	2	1	5	2	4	3	2	2	1	4	2	4	1	2	4	3	2	1	5	4	3	5	4
29	4	1	2	2	2	3	4	2	4	3	2	4	3	2	2	1	2	2	1	4	4	3	1	1	2	4	2	2	4	3
30	4	1	1	1	1	2	3	1	2	3	1	5	4	2	1	1	3	3	4	2	3	3	1	2	2	3	1	1	5	4
31	5	1	3	2	1	2	5	2	2	4	3	5	2	4	1	1	4	2	5	2	2	3	1	2	1	4	3	2	5	3
32	4	2	3	3	1	3	4	2	3	4	1	5	3	3	2	3	5	2	5	2	5	2	1	2	4	3	1	2	5	4
33	4	2	3	3	2	1	5	2	2	5	2	4	3	3	3	3	4	1	4	2	3	2	1	2	2	3	1	3	5	4
34	4	4	3	4	3	3	5	3	3	5	4	5	4	5	4	4	3	2	5	4	4	4	3	4	3	5	4	4	4	4
35	3	3	3	3	4	5	5	5	4	3	5	3	3	3	3	3	4	4	4	2	4	4	3	3	4	4	3	4	5	5
36	4	2	2	1	1	3	3	2	3	4	3	4	4	3	3	3	5	4	4	3	3	4	2	2	1	2	2	2	2	4
37	5	2	3	3	2	3	4	2	3	3	1	4	3	2	2	3	3	2	3	2	5	2	2	2	3	3	1	2	4	3
38	4	2	3	3	2	2	4	2	3	5	1	5	4	3	3	3	4	1	5	3	4	4	1	2	2	5	3	5	4	3
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Respondent	Slide																													
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5	3	1	3	1	1	4	2	4	2	5	4	2	3	3	3	2	4	2	4	2	1	2	5	5	3	5	2	2	4	4
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10	3	1	4	1	2	4	3	3	3	3	4	3	4	3	3	2	3	2	3	2	2	3	3	2	2	3	1	2	2	1
11	3	1	3	2	4	5	3	2	2	3	5	2	4	2	4	1	4	2	4	3	4	2	3	3	2	5	2	1	3	3
12	2	5	3	3	5	5	4	3	1	5	5	2	3	1	4	2	3	3	4	2	4	2	4	4	5	5	2	2	4	3
13	4	4	3	1	4	3	4	3	5	4	5	3	4	3	5	2	3	4	5	3	5	3	4	3	5	5	4	2	2	3
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22	2	2	3	3	4	1	1	3	2	2	4	2	4	3	3	2	4	1	4	2	3	1	5	3	2	5	3	2	5	5
23	1	1	2	1	1	3	1	2	1	4	2	2	4	1	2	1	3	2	4	1	1	1	3	2	2	5	2	1	3	3
24	3	1	2	1	2	3	4	3	2	4	4	3	4	3	1	2	4	2	4	3	1	3	3	4	3	5	3	3	4	3
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27	1	1	2	4	5	5	3	3	2	4	5	3	3	2	4	2	4	1	2	2	3	2	4	2	2	5	2	4	5	3
28	2	2	2	3	5	4	4	2	4	4	5	3	3	2	5	4	4	5	4	4	5	2	4	4	5	5	3	3	2	3
29	4	2	1	2	4	3	3	2	4	3	4	1	1	1	2	1	3	2	2	2	3	2	3	4	4	5	2	1	2	3
30	1	1	1	1	1	5	2	2	1	4	1	1	1	1	5	1	3	1	3	2	1	1	1	1	1	4	1	1	1	1
31	2	4	3	2	4	2	2	2	4	3	4	3	4	3	5	1	2	3	4	3	4	2	3	4	4	5	3	1	3	4
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33	3	2	2	1	4	3	4	2	3	4	4	2	4	3	5	1	2	3	3	3	4	3	1	3	3	5	2	2	1	4
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35	3	1	4	1	1	4	3	4	1	4	4	3	3	3	4	3	4	3	4	3	1	2	4	4	4	5	4	3	3	4
36	3	1	2	2	3	3	2	3	1	4	1	2	2	2	2	2	3	2	4	1	1	1	1	3	2	4	3	3	4	4
37	2	1	1	1	4	3	3	2	4	2	3	2	3	2	5	2	3	3	2	2	4	3	1	4	3	5	3	3	2	3
38	3	5	4	4	5	4	3	2	4	4	5	3	4	3	5	1	2	2	3	3	4	2	2	3	2	5	3	2	2	1
39	2	1	2	2	1	3	3	2	2	2	3	2	2	3	4	1	2	2	3	2	3	2	2	1	2	3	2	2	2	2
40	2	1	1	1	1	1	1	1	2	2	1	3	2	1	1	1	2	2	2	3	3	1	1	1	1	1	1	1	1	1
41	5	3	2	1	2	3	1	1	2	4	1	5	4	3	2	1	3	3	2	3	4	4	3	2	4	2	2	1	1	4
42	5	4	2	2	2	4	1	2	4	4	2	2	4	3	2	1	3	4	2	2	2	4	3	1	3	1	2	2	2	4
43	5	3	1	2	2	1	1	2	4	5	2	3	4	1	2	1	2	3	4	2	1	4	2	1	2	1	1	3	1	5
44	2	4	2	5	2	2	1	1	4	5	2	4	3	3	2	2	3	5	5	5	2	4	1	1	1	2	3	5	4	5
45	4	3	2	2	3	2	1	1	3	3	1	2	3	2	1	2	2	3	4	3	3	2	3	3	3	2	2	2	2	4
46	4	3	2	1	2	2	3	1	2	2	1	3	2	3	2	2	3	4	4	1	3	2	2	2	2	2	3	2	1	2
47	5	3	2	1	2	3	2	1	3	4	1	2	2	2	1	1	2	3	4	2	2	4	2	3	3	2	2	2	1	2
48	4	5	3	1	2	2	4	3	1	4	4	4	3	4	3	3	5	5	4	3	3	4	1	3	4	4	5	1	4	2
49	5	5	4	2	3	4	3	2	3	4	3	5	3	4	3	3	3	5	4	1	2	3	3	2	4	3	3	3	3	4

TABLE 15 (continued)

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52	2	3	3	2	4	1	2	1	2	1	2	2	2	3	1	2	1	2	2	3	2	2	1	2	2	2	1	2	1	1
53	3	3	4	4	4	5	3	2	3	4	3	2	4	1	4	3	4	1	1	4	3	2	4	5	2	2	2	3	2	2
54	3	2	4	4	5	3	4	3	4	5	4	4	3	3	2	4	4	4	3	3	4	1	2	3	4	1	2	2	1	3
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57	2	3	4	4	5	3	5	2	1	2	2	3	3	3	2	1	2	2	2	2	5	4	2	2	3	4	4	3	1	2
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61	3	2	2	2	4	2	4	1	3	3	2	3	2	1	1	2	2	4	2	1	5	4	4	2	5	4	2	1	1	2
62	3	4	3	4	5	3	3	3	2	3	2	4	3	5	2	5	2	3	3	4	5	4	2	2	4	5	3	3	2	1
63	3	3	5	5	4	4	2	1	5	1	5	2	4	3	3	1	4	2	5	1	4	1	3	4	3	1	1	2	1	4
64	4	3	4	1	5	3	2	2	4	4	2	3	2	3	3	4	4	5	1	2	5	1	1	2	5	1	2	3	1	2
65	4	4	3	3	5	3	2	2	3	3	3	3	2	4	2	4	3	3	2	2	5	4	3	2	4	3	2	2	1	2
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97	1	2	2	2	3	4	3	3	3	3	3	2	2	3	3	1	3	2	3	3	3	2	1	2	3	2	2	2	1	2
98	5	5	2	2	5	4	3	5	2	5	2	4	1	4	1	4	2	5	2	1	5	2	2	1	4	1	1	3	1	4

Respondent	Slide 31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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51	4	3	2	3	4	4	3	2	2	4	3	5	4	3	3	3	3	3	5	3	3	3	2	4	4	2	3	1	2	4
52	3	4	2	1	5	2	2	2	2	3	2	5	1	2	2	2	2	3	5	4	5	1	2	3	2	2	1	2	1	3
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61	5	4	2	1	3	4	2	1	3	5	2	5	4	4	2	2	2	4	3	1	2	3	3	2	4	1	1	3	2	4
62	4	3	1	2	3	3	2	1	4	5	1	5	2	2	1	1	3	2	5	3	5	4	3	3	3	2	1	1	2	4
63	5	3	5	1	2	4	2	3	1	2	4	1	3	1	3	4	1	5	1	1	2	4	1	2	4	3	4	2	2	1
64	5	5	2	1	3	4	1	1	3	4	1	2	2	4	1	1	3	4	3	1	2	5	1	1	3	2	2	2	1	4
65	3	4	3	2	2	4	2	3	4	4	2	3	1	2	1	1	2	4	5	4	3	3	2	3	3	2	3	4	3	4
66	2	3	1	2	2	2	2	1	3	4	2	2	2	2	2	2	2	4	4	1	2	3	2	2	3	2	3	2	2	1
67	4	4	2	3	4	1	2	1	2	2	2	5	2	2	1	2	4	4	2	3	3	1	2	4	1	2	2	3	1	4
68	5	5	2	1	3	3	2	2	3	5	2	4	1	3	3	3	4	4	5	4	3	2	2	1	2	1	2	1	2	4
69	5	5	1	1	4	4	3	2	3	4	3	4	3	4	2	2	3	4	5	2	4	3	3	3	3	2	2	2	2	5
70	4	5	1	1	2	3	1	1	2	4	1	5	4	3	1	1	5	4	5	2	4	2	2	4	3	1	1	1	1	5
71	4	5	3	1	4	3	2	3	3	4	2	5	2	4	4	4	5	4	4	2	3	3	2	4	2	1	3	1	2	4
72	5	5	1	2	2	3	2	2	3	5	2	4	2	4	3	3	2	2	4	4	2	3	2	2	3	1	2	2	1	4
73	3	4	3	2	3	3	3	3	4	5	2	5	4	3	2	2	3	4	3	2	2	3	3	2	4	2	2	2	2	5
74	5	5	3	1	5	4	3	3	3	3	3	4	3	5	3	3	5	5	5	2	4	4	4	3	3	2	2	1	3	2
75	4	5	3	2	4	4	4	3	2	4	3	5	3	4	4	3	4	5	4	2	4	3	3	4	4	3	3	2	2	3
76	5	3	3	2	4	4	3	3	3	5	3	4	2	3	3	3	3	5	3	2	4	3	3	3	3	2	2	3	2	3
77	5	5	1	3	5	2	2	4	3	4	3	1	2	4	3	3	3	2	4	3	3	5	2	2	5	3	3	1	2	1
78	5	4	2	3	4	4	2	1	4	4	2	5	3	2	1	2	2	4	5	4	4	5	3	4	4	2	2	2	3	5
79	2	5	2	3	4	3	1	3	3	3	2	5	2	2	1	2	3	5	4	4	2	3	3	2	2	2	1	3	4	5
80	4	5	3	2	5	1	2	3	3	3	2	5	1	2	3	3	5	4	5	1	4	3	3	4	2	2	3	2	2	4
81	4	2	2	3	3	2	2	4	4	2	3	5	3	2	2	2	2	3	4	4	5	3	4	3	4	3	2	2	1	3
82	4	2	1	2	2	2	1	1	2	3	1	3	3	3	1	1	1	4	4	3	4	3	2	3	2	1	1	3	2	3
83	4	2	2	3	2	2	2	2	2	4	2	2	3	2	2	2	2	2	3	2	2	2	2	2	2	1	1	1	1	5
84	5	4	3	4	3	4	3	2	4	5	2	4	2	3	2	3	2	3	5	4	3	3	1	2	3	1	2	2	3	4
85	4	4	3	2	3	2	2	2	4	5	3	5	4	4	2	3	4	4	5	4	4	3	3	3	4	2	3	2	3	4
86	5	4	2	3	3	2	4	3	3	5	2	4	3	4	3	3	4	5	2	2	3	3	4	1	3	4	2	2	3	5
87	3	4	2	2	3	2	3	1	3	4	2	5	3	3	2	3	3	3	4	1	3	2	2	2	3	1	2	1	1	4
88	4	3	1	1	2	3	1	1	2	2	1	2	1	1	1	2	2	3	5	4	3	2	2	2	2	2	2	2	2	5
89	3	3	2	2	3	3	2	1	3	3	2	3	2	3	2	3	3	4	3	2	2	3	4	2	3	2	2	3	3	5
90	3	4	2	4	3	5	5	2	2	2	4	3	4	5	5	1	5	5	2	5	2	5	3	2	2	4	4	5	2	2
91	5	4	1	1	4	2	2	1	4	5	2	5	2	2	1	1	4	4	5	3	5	3	2	4	2	1	2	2	1	5
92	5	4	1	2	5	2	2	1	5	5	1	5	2	2	1	1	3	4	5	4	2	2	3	4	4	2	1	3	3	5
93	4	5	2	2	3	3	3	3	4	4	2	5	3	2	2	3	2	4	5	1	3	3	4	3	2	3	4	1	2	1
94	3	2	1	2	2	4	1	1	4	5	1	3	2	3	1	1	2	4	3	1	2	2	2	1	3	1	2	3	2	4
95	3	5	2	2	4	3	3	1	2	4	1	5	4	3	2	2	4	4	2	3	5	4	3	3	4	2	3	1	2	3
96	3	4	2	2	3	2	2	2	3	3	2	3	2	2	2	2	2	3	4	2	3	2	3	2	3	2	2	1	2	3
97	3	3	2	2	3	3	3	2	2	3	2	3	3	2	2	2	2	3	3	3	3	3	3	2	3	4	4	3	2	3
98	5	5	1	3	5	3	4	1	3	5	2	5	5	3	2	2	4	5	3	4	4	2	4	3	4	2	4	2	3	1

TABLE 16

PREFERENCE MEAN RATINGS FOR EACH RESPONDENT PER VISUAL UNIT

Respondent	LR-U	LR-L	BR-U	BR-L	CM	ALL
1	3.10	2.60	2.60	2.40	2.30	2.55
2	1.90	2.70	2.60	2.60	2.10	2.33
3	3.00	3.90	3.20	2.70	2.60	3.00
4	3.60	4.00	3.70	3.70	2.70	3.40
5	3.50	3.60	3.40	4.00	2.45	3.23
6	3.70	4.30	3.20	3.00	2.10	3.07
7	2.80	2.20	3.30	2.70	2.65	2.72
8	2.70	2.70	3.70	2.50	2.70	2.83
9	3.40	3.60	3.40	3.40	2.40	3.10
10	2.70	3.00	2.90	3.60	2.65	2.92
11	3.10	3.60	3.40	3.30	2.20	2.97
12	3.40	4.10	4.00	4.10	2.60	3.47
13	3.80	4.10	3.40	3.10	3.10	3.43
14	2.30	2.10	2.00	2.30	1.65	2.00
15	4.20	3.80	3.40	4.10	2.90	3.55
16	2.30	3.30	2.40	2.80	2.20	2.53
17	3.00	3.10	3.10	2.30	2.85	2.87
18	3.60	3.60	3.60	3.20	3.05	3.35
19	3.40	3.30	3.40	3.00	3.20	3.25
20	3.10	3.10	3.30	3.60	2.80	3.12
21	3.80	3.60	3.20	3.40	3.70	3.57
22	3.70	3.70	3.40	2.30	1.90	2.82
23	3.50	2.80	2.50	3.20	1.40	2.47
24	3.00	3.30	3.40	3.60	3.15	3.27
25	3.10	3.40	2.80	3.30	3.25	3.18
26	2.50	3.10	3.10	2.90	3.10	2.97
27	3.00	3.90	3.10	3.70	2.25	3.03
28	3.40	4.10	3.60	2.70	2.90	3.27
29	2.40	3.30	2.60	2.80	2.05	2.53
30	2.20	2.80	1.40	3.00	1.35	2.02
31	3.60	3.90	3.60	2.30	2.05	2.92
32	2.70	3.00	2.60	3.70	2.60	2.87
33	2.90	3.20	3.20	2.60	2.55	2.83
34	4.10	3.50	4.40	3.10	3.60	3.72
35	3.60	3.40	3.10	4.20	3.10	3.42
36	2.80	2.70	2.40	3.30	2.20	2.60
37	2.20	3.30	3.00	2.90	2.45	2.72

KEY: LR-U = Logan River Upper Waterscape Unit
LR-L = Logan River Lower Waterscape Unit
BR-U = Bear River Upper Waterscape Unit
BR-L = Bear River Lower Waterscape Unit
CM = Central Marsh Setting Unit
ALL = All Units

TABLE 16 (continued)

Respondent	LR-U	LR-L	BR-U	BR-L	CM	ALL
38	3.90	3.70	3.20	2.90	2.65	3.17
39	2.40	2.50	2.70	2.40	2.15	2.38
40	2.20	1.30	1.40	1.40	1.20	1.45
41	2.80	2.40	2.40	3.80	2.20	2.63
42	2.20	2.80	2.40	4.00	1.90	2.53
43	2.80	3.30	2.70	3.60	2.05	2.75
44	3.00	3.00	3.60	2.70	2.20	2.78
45	2.90	3.10	2.60	2.80	1.90	2.53
46	2.50	2.90	2.40	2.40	2.40	2.50
47	2.30	3.00	1.90	3.40	1.90	2.40
48	2.30	2.40	2.70	3.50	3.60	3.02
49	2.70	2.90	3.20	3.50	2.75	2.97
50	3.90	4.90	4.40	4.80	4.45	4.48
51	2.90	2.50	2.70	3.50	2.70	2.83
52	3.10	2.70	1.90	1.90	1.90	2.23
53	2.60	2.40	2.90	4.00	3.70	3.22
54	2.50	2.50	3.20	2.80	2.95	2.82
55	2.90	2.50	2.90	3.60	2.50	2.82
56	2.80	2.80	3.20	3.00	2.45	2.78
57	3.10	3.00	2.90	3.30	2.45	2.87
58	2.40	2.30	2.80	3.00	2.55	2.60
59	3.10	3.20	2.60	2.60	1.95	2.57
60	2.60	2.90	3.20	2.40	2.10	2.55
61	2.50	2.60	2.70	4.30	1.95	2.67
62	3.60	4.10	2.80	3.40	1.95	2.97
63	1.70	1.70	1.60	3.30	4.05	2.73
64	2.30	2.60	2.80	3.80	2.15	2.63
65	2.70	3.70	2.90	3.20	2.45	2.90
66	1.70	2.50	1.90	2.60	1.85	2.07
67	3.00	2.90	2.80	2.10	2.00	2.47
68	3.10	2.60	2.40	3.00	2.45	2.67
69	3.70	3.60	3.00	3.80	2.05	3.03
70	3.20	3.30	2.40	3.00	1.40	2.45
71	2.90	3.10	3.20	3.40	2.80	3.03
72	2.60	2.90	1.90	3.70	2.40	2.65
73	2.90	3.20	2.90	3.70	2.95	3.10
74	3.30	2.90	2.80	3.80	3.05	3.15
75	3.10	3.10	3.30	3.60	3.35	3.30
76	2.90	2.40	3.00	3.50	2.70	2.87
77	2.70	3.00	2.50	4.10	3.00	3.05
78	3.70	3.70	2.70	3.60	2.40	3.08
79	3.80	3.40	3.30	2.60	2.30	2.95
80	2.90	3.30	3.20	2.20	2.90	2.90

TABLE 16(continued)

Respondent	LR-U	LR-L	BR-U	BR-L	CM	ALL
81	3.60	3.00	2.50	3.20	2.35	2.83
82	2.70	3.10	2.30	3.10	1.75	2.45
83	2.30	2.10	2.70	2.30	1.90	2.20
84	2.60	3.00	3.10	3.80	2.20	2.82
85	3.60	3.00	3.30	3.70	2.90	3.23
86	3.30	3.00	3.10	3.50	2.85	3.10
87	2.90	2.90	2.90	3.10	2.50	2.80
88	2.60	2.40	2.40	2.10	1.60	2.12
89	2.50	2.30	3.00	2.70	2.05	2.43
90	3.90	3.00	2.80	3.60	3.15	3.27
91	3.50	4.00	3.20	3.00	1.95	2.93
92	3.60	3.50	3.50	3.20	1.50	2.80
93	2.80	3.50	2.50	2.90	2.95	2.93
94	2.00	2.60	2.60	3.00	1.60	2.23
95	3.70	3.50	2.80	3.50	2.25	3.00
96	2.80	2.90	2.50	2.70	2.15	2.53
97	2.50	2.30	2.40	2.70	2.65	2.53
98	3.60	3.50	3.20	3.80	2.30	3.12

Appendix B

Perceptual Variables Definitions for Judges

Perceptual Variables Definitions for Judges

CONCEPT #1: (Coherence) (S. Kaplan, 1975; R. Kaplan, 1975; Gallagher, 1977)

The extent to which the scene "hangs together". Redundant elements, textures, and structural features are present which allow prediction from one portion of a scene to another.

Organization that causes elements to be perceived as groups.

Anything that causes elements to be perceived as groups, or helps organize the many elements in a scene into a few major units. Those factors which make the "picture plane" easier to organize, to comprehend, to structure. Strengthened by anything which makes it easier to organize the patterns of light and dark into a manageable number of major objects and/or areas. These include repeated elements and smooth textures that identify a "region" or area of the "picture plane".

Dealing only with two-dimensional "picture plane" elements.

CONCEPT #2: (Complexity) (R. Kaplan, 1975; S. Kaplan, 1979; Herzog, Kaplan and Kaplan, 1976; Gallagher, 1977)

The number of visual elements in a scene.

How intricate the scene is; whether it contains many different elements.

Reflects how much is "going on" in a particular scene, how much there is to look at.

CONCEPT #3: (Mystery) (Gallagher, 1977; S. Kaplan, 1975; R. Kaplan, 1975)

Where going further into the scene seems likely to provide more information. It must appear possible to enter a scene, and that there be somewhere to go. An obstruction at the edge of a scene that one might go around to learn more, some opening in the foliage deep in the scene one might pass through, the bend in the path which disappears in the forest all relate to this concept.

It concerns the promise of new information, rather than the new information *per se*.

The promise of further information based on a change in the vantage point of the observer. Consider whether you would learn or experience more if you could move deeper into the scene.

CONCEPT #4: (Legibility) (S. Kaplan, 1975, 1979)

Entails a promise, a prediction, of the opportunity to function. It is concerned with interpreting the space, with finding one's way and with finding one's way back. It deals with the structuring of space, with its differentiation, with its readability.

It deals with the organization of the ground plane, of the space that extends out from the foreground to the horizon.

A scene with a high expression of this concept is one that is easy to see and to form a "mental map" of.

It involves the ease with which one can perceive the space as divided up into sub-areas or regions.

Appendix C

Survey Response Form

Survey Response Form

Date ____________ Age _________ Home (State) _________

Group ___________ Sex _________ Major _______________

Recreation Interests (check major three):

___ Backpacking/Hiking	___ Golf	___ Snow Skiing
___ Ballgames	___ Hunting	___ Tennis
___ Camping	___ Motor boating	___ Theatre
___ Canoeing	___ Photography	___ Water Skiing
___ Film	___ Racquetball	___ Wildlife observation
___ Fishing	___ Sailing	___ Other (___________)

INSTRUCTIONS

Evaluate the displayed scenes according to:

HOW PLEASING DO YOU FIND THE SCENE, OR HOW MUCH DO YOU LIKE THE SCENE?

THEN RANK THE DISPLAYED SCENES, on a scale of:

	1	2	3	4	5	
like it very little						like it very much

CIRCLE THE APPROPRIATE NUMBER. Make an effort to use the entire range of the scale; in other words, don't be so critical that the extremes of the scale (1 and 5) are impossible to achieve.

Evaluate each scene according to its own merit, not in comparison to other scenes in this exercise.

SAMPLE SCENES:

1.) 1 2 3 4 5
2.) 1 2 3 4 5
3.) 1 2 3 4 5

SURVEY SCENES:

1.) 1 2 3 4 5	21.) 1 2 3 4 5	41.) 1 2 3 4 5
2.) 1 2 3 4 5	22.) 1 2 3 4 5	42.) 1 2 3 4 5
3.) 1 2 3 4 5	23.) 1 2 3 4 5	43.) 1 2 3 4 5
4.) 1 2 3 4 5	24.) 1 2 3 4 5	44.) 1 2 3 4 5
5.) 1 2 3 4 5	25.) 1 2 3 4 5	45.) 1 2 3 4 5
6.) 1 2 3 4 5	26.) 1 2 3 4 5	46.) 1 2 3 4 5
7.) 1 2 3 4 5	27.) 1 2 3 4 5	47.) 1 2 3 4 5
8.) 1 2 3 4 5	28.) 1 2 3 4 5	48.) 1 2 3 4 5
9.) 1 2 3 4 5	29.) 1 2 3 4 5	49.) 1 2 3 4 5
10.) 1 2 3 4 5	30.) 1 2 3 4 5	50.) 1 2 3 4 5
11.) 1 2 3 4 5	31.) 1 2 3 4 5	51.) 1 2 3 4 5
12.) 1 2 3 4 5	32.) 1 2 3 4 5	52.) 1 2 3 4 5
13.) 1 2 3 4 5	33.) 1 2 3 4 5	53.) 1 2 3 4 5
14.) 1 2 3 4 5	34.) 1 2 3 4 5	54.) 1 2 3 4 5
15.) 1 2 3 4 5	35.) 1 2 3 4 5	55.) 1 2 3 4 5
16.) 1 2 3 4 5	36.) 1 2 3 4 5	56.) 1 2 3 4 5
17.) 1 2 3 4 5	37.) 1 2 3 4 5	57.) 1 2 3 4 5
18.) 1 2 3 4 5	38.) 1 2 3 4 5	58.) 1 2 3 4 5
19.) 1 2 3 4 5	39.) 1 2 3 4 5	59.) 1 2 3 4 5
20.) 1 2 3 4 5	40.) 1 2 3 4 5	60.) 1 2 3 4 5

Appendix D

Slides


Slide #1 (BR-U)


Slide #2 (BR-U)


Slide #3 (BR-U)


Slide #4 (CM)


Slide #5 (CM)

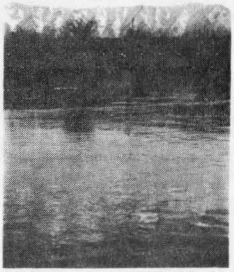

Slide #6 (BR-L)


Slide #7 (LR-L)


Slide #8 (LR-U)

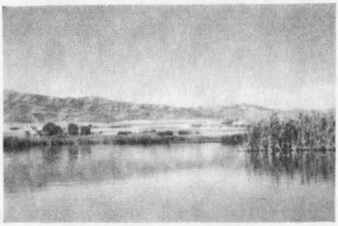
Figure 8. Study Slides.

Slide #9 (BR-L)

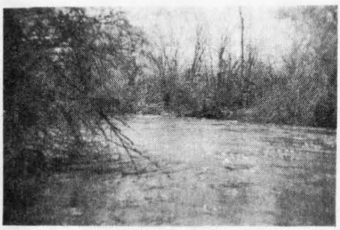


Slide #12 (LR-L)

Slide #10 (LR-U)



Slide #13 (CM)

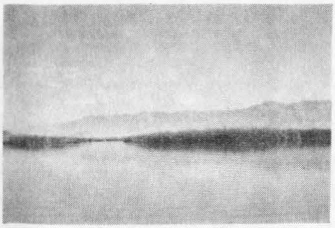


Slide #11 (LR-U)

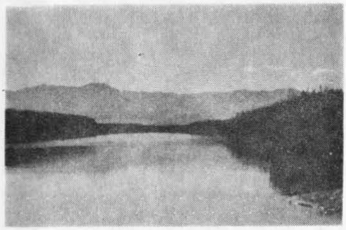
Slide #14 (BR-U)

Figure 8. (continued)

Slide #15 (CM)



Slide #16 (CM)



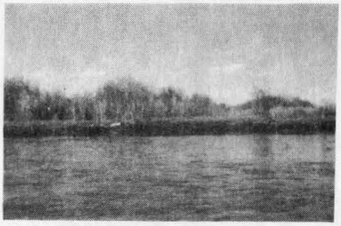
Slide #17 (BR-L)

Slide #18 (BR-L)

Slide #19 (LR-U)

Slide #20 (CM)

Slide #21 (BR-L)



Slide #22 (LR-L)

Figure 8. (continued)

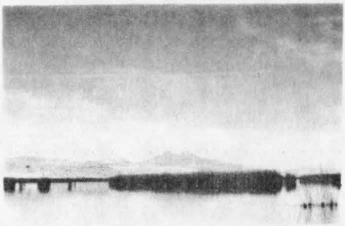
Slide #23 (CM)

Slide #24 (CM)

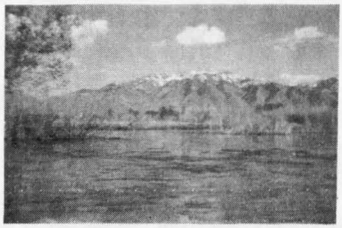
Slide #25 (BR-L)

Slide #26 (LR-U)

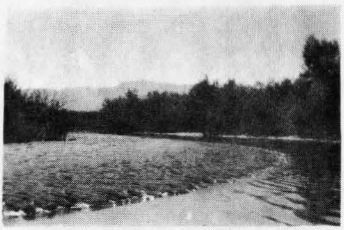
Slide #27 (BR-U)



Slide #28 (CM)



Slide #29 (LR-L)



Slide #30 (BR-L)

Figure 8. (continued)

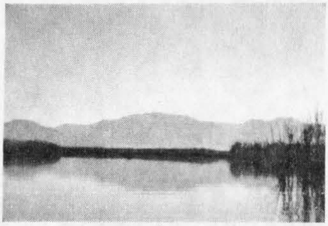
Slide #31 (CM)

Slide #35 (LR-L)

Slide #32 (LR-U)

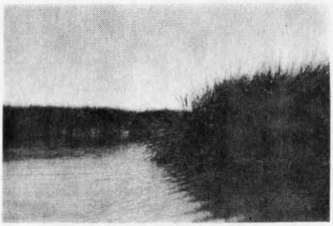
Slide #36 (BR-L)

Slide #33 (LR-U)



Slide #37 (CM)

Slide #34 (LR-U)



Slide #38 (BR-L)

Figure 8. (continued)

Slide #39 (LR-L)

Slide #43 (BR-U)

Slide #40 (BR-L)

Slide #44 (CM)

Slide #41 (BR-U)

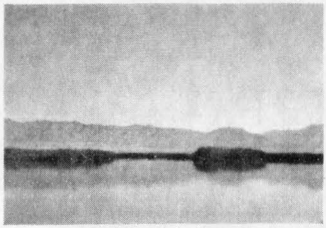
Slide #45 (LR-L)

Slide #42 (CM)

Slide #46 (CM)

Figure 8. (continued)

Slide #47 (LR-L)



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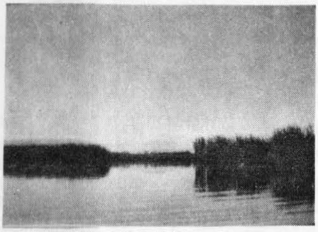

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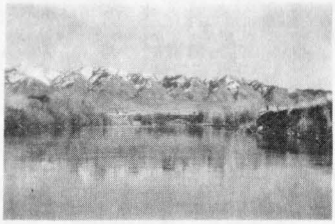

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Slide #52 (LR-L)

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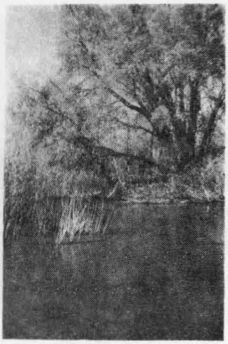
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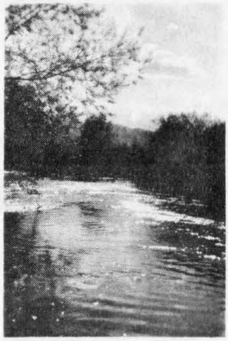
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Slide #54 (BR-U)


Slide #57 (CM)


Slide #55 (CM)

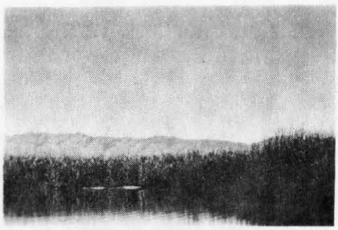
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Figure 8. (continued)

Slide #59 (LR-L)

Slide #60 (BR-U)

Figure 8. (continued)

Appendix E

Cutler Reservoir Study

A VISUAL RESOURCE INVENTORY OF CUTLER RESERVOIR
AND ITS TRIBUTARY STREAMS,
CACHE COUNTY, UTAH

BY

JOHN C. ELLSWORTH

DEPARTMENT OF LANDSCAPE ARCHITECTURE

AND ENVIRONMENTAL PLANNING

UTAH STATE UNIVERSITY

JUNE, 1980

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CHAPTER I

INTRODUCTION AND ACKNOWLEDGMENTS

This research began as part of a comprehensive planning and design study of the Cutler Reservoir wetland by the 1979 second year graduate class in the Department of Landscape Architecture and Environmental Planning at Utah State University and was expanded to its present form in Spring, 1980. The purpose of this document is to describe the visual resource of the study area. This will be done with the use of written descriptions and matrices of biophysically derived visual resource units, with mounted color transparencies which illustrate the descriptions and serve to document the visual experiences of the study area at this particular time, and with plan view maps delineating the visual units.

It is important to emphasize that this study is a qualitative descriptive inventory. There is no attempt to quantify the biophysical/visual characteristics or to assess vulnerability to visual impact, visual absorption capacity, or observer perception or preference.

The work of R. Burton Litton, Jr. has been the major influence on the development of the methodology used in this study (Litton, 1977). Mr. Litton visited the site with the two principal researchers, John C. Ellsworth and Jeffrey A. Hecht, on May 17, 1979 and offered many helpful comments which have been incorporated into this project. His assistance was very valuable and much appreciated. However, the principal researchers assume full responsibility for the interpretation and application to this project of the techniques developed by Mr. Litton and for all decisions and conclusions expressed in this document.

CHAPTER II

OBJECTIVES AND METHODOLOGY

The objectives of this study are:

1. Identify and describe the biophysical factors constituting the visual resource of Cutler Reservoir and its tributary streams according to the methodology of R. Burton Litton, Jr.
2. Identify and describe visual resource units in the study area, according to Litton's methodology.
3. Develop a library of mounted color transparencies illustrating the descriptions and documenting the visual resource of the study area at this particular time.

During Phase I of the research, Ellsworth and Hecht made frequent field visits and photograph excursions to the study area during the spring of 1979. Basic methodology concepts from Litton's work were used as a guide for inventorying the visual resources of the study area. As research proceeded, these concepts were modified to better suit the biophysical aspects of the study area and the objectives of the researchers. Essentially all field observations and photographs were made while traveling by canoe, either in a downstream direction (on the rivers) or in a northward direction.

Upon completion of field visits and photographic documentation, the researchers began the analysis of the data. Biophysical features and tentative visual units were identified during many sessions of comparing field notes and viewing slides of the area. Notes and impressions of the study area were shared by the researchers in order to arrive at more accurate and complete descriptions and to produce a sketch map of the tentative visual units. During Phase II further investigation and geographic delineation of Landscape, Setting, and Waterscape Units according to Litton's methodology was undertaken by Ellsworth the following year, resulting in this document in the Spring of 1980. This report is a summary of both phases of the research.

CHAPTER III

RESULTS

The visual resource inventory will be reported in the following sequence:

1. Biophysical factors identification and discussion.
2. Visual resource units identification and discussion.
3. Color transparencies library description and discussion.

Biophysical Factors Identification and Discussion

The biophysical factors identified as most important in the visual character of the study area are water expression, edge condition, vegetation type, and human use and impact. Secondary conditions of details and ephemeral aspects are also discussed because of their visual impact on the observer.

Water expression affecting the visual character of the study area was determined by inventory and analysis of stream, marsh, and open water character. Illustrative slides are indicated in this section and can be cross-referenced to the summary in the appendix. The following categories of water expression are used:

Stream - Slides: LBR-10, BR-8, BR-7, BR-6, BR-4, BR-3, BR-1, BR-23, BR-25, BR-26, BR-27, BR-39, BR-41, BR-44, BR-57, BR-63

Marsh - Slides: BR-49, BR-52, BR-53, BR-54, BR-55, BR-56, BR-57, BR-58, BR-59, BR-62

Open - Slides: LBR-14, BR-22, BR-17, BR-16, BR-15, NM-12, NM-16, NM-17, NM-18, NM-19, NM-20, NM-21

Edge conditions affecting the visual character of the study area are produced by the expression, convergence and proximity of water, vegetation, and landform. Combinations of these elements which form distinct visual edge conditions are described in geographic sequence from the water towards the land and are summarized as follows:

Water, Emergent Vegetation - Slides: LBR-9, LBR-12, BR-44, BR-52, BR-53, BR-54, BR-55, BR-56

Water, Bare Ground Vegetation - Slides: BR-56, BR-58, BR-59, BR-63

Water, Mud, or Sand, Bare Ground - Slides: BR-60, BR-61, NM-19

Water, Low Bank with Low Vegetation - Slides: LBR-22, LBR-6, BR-19, BR-26, BR-28, BR-47, LR-25, LR-26, LR-28, LR-30, LR-34, LR-35

Water, High Bank with Low Vegetation - Slides: LR-5, LR-53, BR-45, NM-4, NM-5, NM-6, NM-3, LR-38

Water, High Bank with High Vegetation - Slides: LR-59, LR-62, LR-69

Water, Brush Thickets and Trees - BR-37, LR-20, LR-21, LR-29, LR-72

Water, High Banks and Emergents - Slide: BR-21

Vegetation types affecting the visual character of the study area were determined by inventory and analysis of texture, height, color, massing and general growth habit. These types include:

Grasses, Sedges, Forbs, and Grass-Like Plants - Slides: LBR-1, LBR-6, LR-14, LR-25, LR-26, LR-28, LR-30, LR-34, LR-35, LR-38

Reeds - Slides: LBR-9, LBR-12, LBR-14, BR-44, BR-55, BR-56, BR-57, BR-58

Willows and Shrubs - Slides: LR-15, LR-16, LR-21, LR-22, LR-24, LR-27, LR-32, LR-33, LR-37

Trees - Slides: LR-2, LR-3, BR-18, BR-10, BR-26, BR-29, BR-46, NM-1

Teasel - Slides: LR-17, LR-59, LR-62, LR-69

Human use and impact affecting the visual character of the study area were determined by inventory and analysis of scale and degree of visual contrast to the natural or agrarian character of the area. Use and impact categories identified include:

Structures - Slides: LBR-2, BR-14, BR-1, BR-25, BR-33, BR-41

Trash - Slides: BR-21, LR-42

Abandoned Automobiles - Slides: BR-30, BR-22, NM-6, NM-5, NM-23, LR-20, LR-23

Agricultural Artifacts (fences, dams, etc.) - Slides: LR-38, LR-39, LR-53, LR-54, LR-55

Agricultural Fields - Slides: LR-19, LBR-4, LBR-5, LBR-6, LBR-11

Settlements - Slides: LR-28, LR-42

Miscellaneous (utilities, bridges, etc.) - Slides: BR-4, BR-2, BR-34, BR-48, NM-22

Details affecting the visual character of the study area were inventoried during the numerous field visits by the researchers. As with "Ephemeral Aspects" (see next section) these characteristics are not easily mapped but are important in the experience of the visitor and are therefore summarized as follows:

Teasel Vegetation - Slides: LR-17, LR-59

Reeds - Slides: LBR-9, LR-34

Beaver Artifacts - Slides: LR-51, LR-56

Water Surface Conditions (ripples, waves, etc.) - Slides: LR-21

Flowers - Slides: LR-26, LR-65

Water Reflectivity/Light Nuances - Slides: LR-29

Vegetation Detail - Slides: LR-72

Wood Texture - Slides: BR-33

Wildlife - Slides: NM-14, M-1, M-6, CM-7, CM-8, CM-11, CM-15

Ephemeral aspects affecting the visual character of the study area, although not readily mappable are included here to illustrate and document the diversity and intensity of the observer's experience. A clear distinction between "Details" and "Ephemeral Aspects" is not made. The reader will note, however, that some of the factors included in this category are not visual stimuli at all. The intent is to inventory some of the sensual stimuli which cannot be divorced from the visual experience. Aspects identified include:

Aromas - Slides: BR-14, LR-65

Wildlife - Slides: BR-10, BR-9, BR-6, BR-5, BR-4, BR-3, BR-29, BR-51, NM-14, NM-11, LR-48

Sounds - Slides: LR-21, LR-48, BR-6, BR-5, BR-4, BR-3, BR-51, NM-21, NM-20, NM-19, NM-18

Sky and Clouds - Slides: NM-21, NM-11, NM-8, NM-24, LR-30, LR-68, BR-7, BR-50, BR-56

Color - Slides: LR-12, LR-24, LR-25, LR-26, LR-30

Light - Slides: BR-20, BR-33, NM-24, LR-5, LR-29, LR-30, LR-44, LR-60

Texture (tactile, visual) - Slides: BR-26, BR-55, BR-58, BR-63, LR-72, LR-34, LR-56, LR-59, LBR-9

Reflection - Slides:LR-3, LR-4, LR-5, LR-53, LR-61, LR-68, LR-69 BR-46

Shade - Slides: BR-20, LR-27, LR-29, LR-30, LR-49

Visual Resource Units Identification and Discussion

In "River Landscape Quality and its Assessment" (Litton, 1977), three units of river landscape are defined:

Landscape Unit - Based upon regional similarities, or consistencies, of terrain, vegetation, and water elements. It is large and never seen all at one time.

Setting Unit - defined by its visual corridor. It is a segment of one river landscape with reasonably consistent or recognizably similar relations of topography, water, and plants. It may be visible all at one time.

Waterscape Unit - focuses upon the river, water patterns and expression and the immediate riparian zone. It may be part of a stream in a setting unit and may extend beyond as well as be coincident with the setting. This unit serves design and resource management at site scale as intimately related to stream character.

The objective in defining visual units is in Litton's words, "to look for homogeneity. It may be represented by space, form, enclosure; any number of ways to define it. (Be aware of) the importance of sequence and sequential movement." (Litton, 1979)

The Cache Valley of northern Utah may be identified as a Landscape Unit according to Litton's definition. The valley is defined by the mountains of the Bear River Range, the Clarkston peaks, and the Wellsville Mountains. It is approximately twelve miles wide and fifty miles long, thus it is never seen all at one time except from the air. The terrain is gently sloping to flat and the major land uses are farming and livestock production. Vegetation is agricultural, riparian, or urban. There are five major streams in the valley - The Bear River, the Cub River, the Logan River, the Blacksmith Fork River, and the Little Bear River. The Bear River, the Logan River, and the Little Bear River are primary tributaries of Cutler Reservoir, which is impounded behind Cutler Dam on the Bear River. The focus of this inventory is on these three streams and the reservoir.

Following the methodology described in Chapter II, six Setting Units and nine Waterscape Units have been identified in the study area. (See map in appendix):

Setting Units	Waterscape Units
Bear River	Upper
	Lower
Central Marsh	
Little Bear River	Upper
	Lower
Logan River	Upper
	Lower
Meanders	
North Marsh	Upper
	Lower
	Clay Slough

The nine Waterscape Units are coincident within four Setting Units. Definite geographic boundaries between Waterscape and Setting Units do not exist. There are visual transition zones in all cases which exhibit some biophysical features of each contiguous Waterscape or Setting Unit. These zones emphasize the movement from one unit to the next and are very important to the experience of sequential movement. These zones are consistent with Litton's concepts. He states that, "Units may be clean and sharp with hard boundaries within which consistent character and few distracting complexities exist. They may also, however, have diffused boundaries" (Litton, et al., 1974, p. 21).

The expression of biophysical conditions in each visual unit is summarized in Figure 1. The categories of "Details" and "Ephemeral Conditions" have been omitted for reasons stated earlier. The figure, therefore, displays the biophysical conditions of Water Expression, Edge Condition, Vegetation Type and Human Use and Impact expressed in each of the fifteen visual units.

A prose description of visual units is included here so as to convey as completely and accurately as possible the visual resource character of the study area. These descriptions will be presented by Setting Unit. Waterscape Units will be discussed under the heading of the Setting Unit of which they are a part. The Setting Units will be described in the following order (refer to map in appendix):

Little Bear River Setting Unit

Logan River Setting Unit

Meanders Setting Unit

Central Marsh Setting Unit

Bear River Setting Unit

North Marsh Setting Unit

Little Bear River Setting Unit. This unit consists of the visual corridor of the Little Bear River from the Mendon Highway crossing to the Meanders Setting Unit located south of the Valley View Highway (#30).

The unit has two distinct visual sections which are delineated as Waterscape Units. The Upper Waterscape Unit exhibits a sinuous stream character. Traveling by canoe from the Mendon Highway northward, the observer is immediately impressed by the wild character of the great blue heron rookeries and the overhanging branches of the tall trees. Such a character is in contrast to the agrarian and pastoral environment familiar to Cache Valley dwellers. The foreground is visually dominant (little else is visible) and the huge nests of the great birds are powerful visual details.

The visitor quickly moves into a portion of this unit where the trees visually dominate the middle ground and the foreground is dominated by tall emergent vegetation. Movement is sinuous and the feeling of mystery reinforced by directional disorientation and indecision as to which channel of the stream to follow, even though any choice arrives at the same place. The water and emergents then begin to give way to low banks and agricultural lands while the mountains of the Bear River Range loom in the background. The stream becomes deeper and wider, and the presence of trees diminishes. The sinuosity of the stream continues as the observer passes through the visual transition zone and into the Lower Waterscape Unit.

The middle ground is more clearly defined in this unit and the background mountains of the Bear River Range reinforce the majestic panorama. Foreground is not well articulated and contains no dominant visual elements. However, detail becomes important as seen in the texture of emergent vegetation and in the presence in Spring of geese and ducks around the bends in the river. Human impacts are minimal throughout the unit. Croplands, some trash, and an occasional fence are the indications of man.

The unit converges with the Meanders Unit south of Valley View Highway. The transition zone between units is subtle and identified best by a change in vegetation from low emergents to a mixture of low emergents and agricultural pasture.

Logan River Setting Unit. This unit consists of the visual corridor of the Logan River from the Mendon Highway crossing to the Meanders Setting Unit. There is a rich diversity of visual stimuli in this Setting Unit. The river is moderately wide and deep at the Mendon Highway crossing and the float is usually fast. A strong enclosure is provided by low banks, trees, and shrub willow thickets. The upright vegetation is an abrupt visual contrast to the planar quality of the river. This edge is visually important not only because of the sense of enclosure, linear movement, and focus, but also due to the patterns of light, reflection, shade and cast shadow which offer visual diversity and drama. Human impacts are present throughout the unit in the form of abandoned automobiles, trash, croplands, and farm machinery and structures. There is a strong sequential movement as the observer floats downstream. Switchbacking meanders induce disorientation and offer repeated vistas of the Wellsville mountains. The experience of revealment/concealment is apparent in the repeated vistas of the mountains.

Waterfowl observed in the unit include ducks, geese, great blue herons, and night herons. On one field visit a garter snake and porcupine were observed as well as the artifacts of an industrious beaver. The switchback character of the river allows for close and unexpected approaches to the wildlife.

This unit also has two distinct sections which are described as Waterscape Units. The transition occurs approximately half-way through the Setting Unit as the enclosure by brush and trees is replaced by high banks and cropland. The background becomes more noticeable and occasional views of middle ground, which were absent in the Upper Waterscape Unit, begin to appear in the Lower Waterscape Unit. The Logan River Setting Unit merges with the Meanders Setting Unit south of Valley View Highway. The transition is subtle, similar to, and geographically inseparable from the transition between the Little Bear River and Meanders Setting Unit.

Meanders Setting Unit. This unit consists of the visual envelope of the meanders of the Little Bear and Logan Rivers near their confluence south of Valley View Highway. The edges of the unit are low banks and low agricultural vegetation with some brush and many emergents. There is a minimal sense of enclosure and the view is often panoramic. The Water Expression at times is marsh, open water, or stream channel with no distinct boundaries between. Foreground, middle ground, and background compete for visual dominance. Wildlife is abundant in the Spring and Fall. Ducks, geese, sandhill cranes, snipes, avocets, black-necked stilts, killdeers, and other shore birds can be seen. Cropland and livestock are an important part of the visual resource but do not detract from the observer's sense of visual unity.

The unit is abruptly bounded on the north by the Valley View Highway bridge where it meets the Central Marsh Setting Unit. The transition zone is necessarily narrow and immediate.

Central Marsh Setting Unit. This unit consists of the visual sphere of the relatively vast central portion of Cutler Reservoir. The interior portion of the unit has large areas of open water that are fringed by more marsh-like environs. The view is always panoramic and the often smooth-surfaced water and low vegetation is strongly expressed and dominant in the foreground and middle ground. Background is dominated by the encircling mountains. A feeling of travel disorientation is common due to the undulating and discontinuous edge conditions which form many small bays and inlets. The edge vegetation is mainly emergents or very low banks with short grasses and attendant emergents. Scale in this unit is large, in the sense that almost the entire Cache Valley and surrounding mountains can be seen. The sky is limited only by the visual edge of the mountain ridges. Waterfowl is bountiful--ducks, geese, shore birds, and most impressive of all, the flocks of one hundred or more great white pelicans. Details include algal blooms and diverse vegetation patterns and textures, and the ever-present stirring of the shallow water by the carp.

The unit blends with the North Marsh Setting Unit at its northern edge. The transition zone occurs just north of the old railroad alignment where the water becomes more open and loses most of the emergent vegetation.

Bear River Setting Unit. This unit consists of the visual corridor of the Bear River from the Highway 218 crossing to the confluence with the North Marsh Setting Unit. The Bear River is the major tributary of Cutler Reservoir and is generally wider and deeper than the Logan River or the Little Bear River.

In the Upper Waterscape Unit the Bear River is characterized by a perceptible flow and subtle variations in edge condition and vegetation type. The edge may be open with low banks, grass, and an occasional farmhouse or the thick brush and trees may grow down to the water forming an impenetrable visual barrier. The mountains to the East and West are less apparent due to the oblique angle of the course of the river and the screening vegetation. The stream reaches are often straight, affording long downstream views. In the first half of the Upper Waterscape Unit, trash is minimal (an occasional car body). There are some utility lines and bridges.

Downstream from the bridge crossing north of Benson School, the flood plain of the stream is wide and depressed. It allows many views of the rolling lands to the northwest. The evidence of human use and impact is more prevalent. There are more buildings (at Benson School and Benson), feedlots, and agricultural fields. Waterfowl and cranes are noticeable but not dominant and details are scarce, often best exemplified in vegetation texture, agricultural artifacts, and bridges and utility lines. The Upper Waterscape Unit merges with the Lower Waterscape Unit at the bridge crossing on the farm road north from Benson townsite.

The Lower Waterscape Unit is remarkably different from the Upper Waterscape Unit in all of the biophysical conditions considered important to this inventory. Water expression is primarily stream character although at times it is difficult to distinquish which channel is the main one. Vegetation is predominantly willow and emergents and the edge is sometimes continuous, sometimes discontinuous. Sand bars and barren shore are not uncommon. Human use and impact is minimal and always subtle, whether it be in the foreground, middleground, or background. The water is slow, if any movement is evident at all. The general character of this Waterscape Unit is a blend of marsh (expressed by the vegetation and edge condition) and river (expressed by the vaguely recognizable stream channels).

The transition with the North Marsh Setting Unit is gradual and anticipated by the frequent revealed views into the open expanse of water that is the North Marsh Setting Unit.

North Marsh Setting Unit. This unit consists of the open water and clay slough tributary north of the Central Marsh Setting Unit and west of the Bear River Setting Unit. It encompasses three Waterscape Units: the Upper, the Lower, and the Clay Slough.

The visual experience can be quite different in this Setting Unit dependent upon the adjacent unit from which it is entered. The wide planar quality is a contrast to the enclosure of the Bear River and yet the high banks of the north side and directional orientation towards the Cache Junction bridge contrast the unlimited open quality of the Central Marsh.

The Upper Waterscape Unit extends from the Benson Marina bridge to the expansive shared transition zone of the Bear River Lower Waterscape Unit, the North Marsh Upper and Lower Waterscape Units, and the Clay Slough Waterscape Unit. The water expression in this unit is generally open and lacustrine. In fact, water skiing is a recreational activity here. Edges are typically agricultural fields with some emergent vegetation. This unit has the least vertical relief of any unit identified, even less than the Central Marsh Setting Unit where vertical relief is expressed in an abundance of emergent vegetation. This unit is also the least visually diverse.

The Lower Waterscape Unit extends from the large transition zone mentioned above to the Cache Junction bridge. Visually dominant elements include the heron rookeries on the south shore and the swath of abandoned automobiles on the north shore. The open water between these elements is visited by large flocks of gulls and pelicans. The views are typically panoramas and wide angle vistas. Sky and clouds are very important in the view of the mountains of the Bear River Range. The Wellsville mountains are less important visually than they were in the Central Marsh Setting Unit. Edge condition is expressed in sandy shores on the south, high barren banks on the north, and agricultural fields on the east. The unit is bounded on the west by the Cache Junction bridge. The approach to the bridge is through wide, open and shallow water. The foothills west of the bridge provide a sense of enclosure.

The Clay Slough Waterscape Unit is bordered on the north by the Highway 218 bridge crossing. The entire unit has a stream character although the vegetation at the north end is emergents (similar to the Central Marsh Setting Unit) and at the south end the vegetation is typically agricultural fields. Edge condition is consistently low banks and human use and impact is restricted to agriculture, a road crossing, and an occasional farmhouse. The unit merges with the other Waterscape Units in the large transition zone mentioned earlier.

Color Transparencies Library and Remarks

Color transparencies of all setting units have been catalogued and coded. The slides are labeled according to the following code:

LBR - Little Bear River Setting Unit

LR - Logan River Setting Unit

M - Meanders Setting Unit

CM - Central Marsh Setting Unit

NM - North Marsh Setting Unit

All slides are numbered sequentially in a downstream or northward direction.

All photographs were taken in the Spring, Summer and Fall of 1980.

The slides may be cross-referenced to the physical features described earlier or may be used as a visual record of each Landscape Unit, Setting Unit, and Waterscape Unit. The slides are kept on file by the author. Representative slides of biophysical factors and visual units are included in Appendix Figure 2.

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APPENDIX

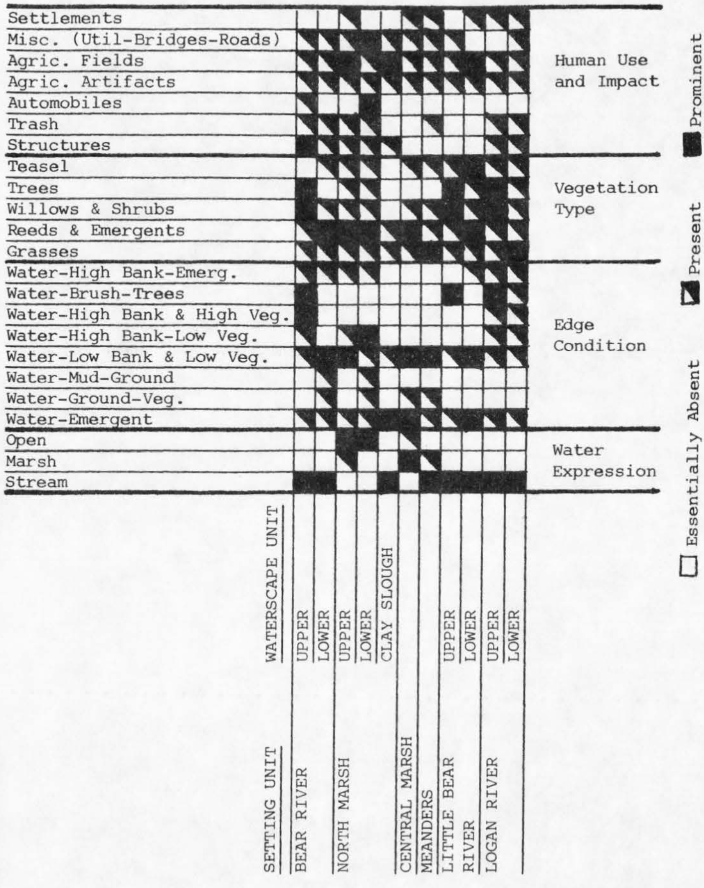


Figure 1. Visual resource inventory.

BEAR RIVER SETTING UNIT

Upper Waterscape Unit | Lower Waterscape Unit

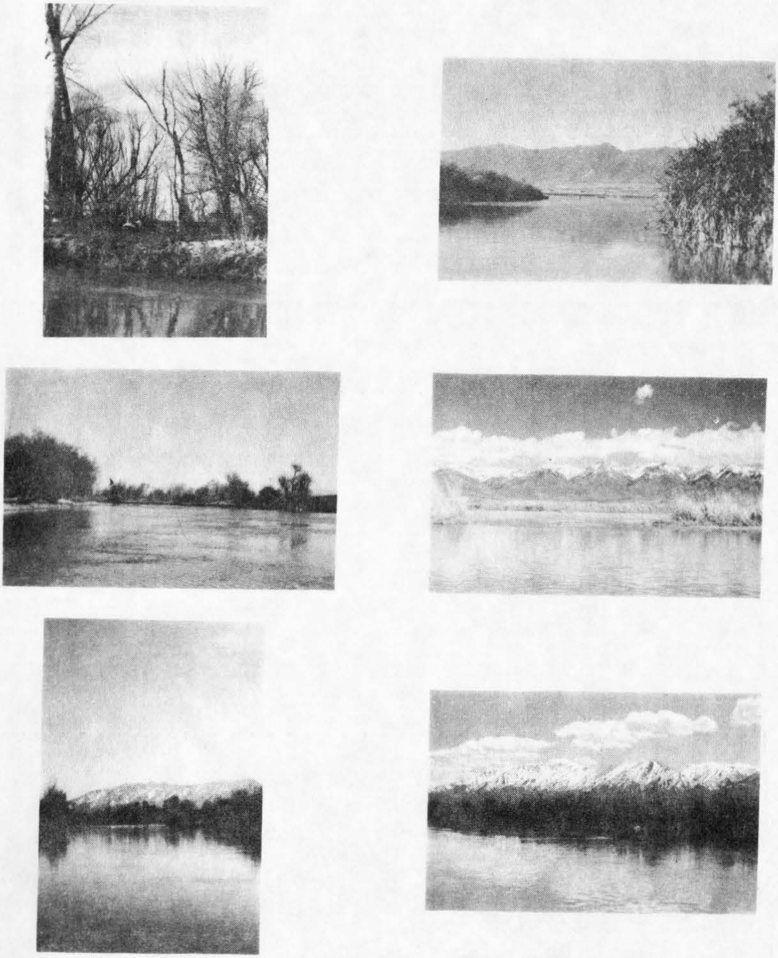


Figure 2. Representative slides of biophysical factors and visual units.

LITTLE BEAR RIVER SETTING UNIT

Upper Waterscape Unit | Lower Waterscape Unit

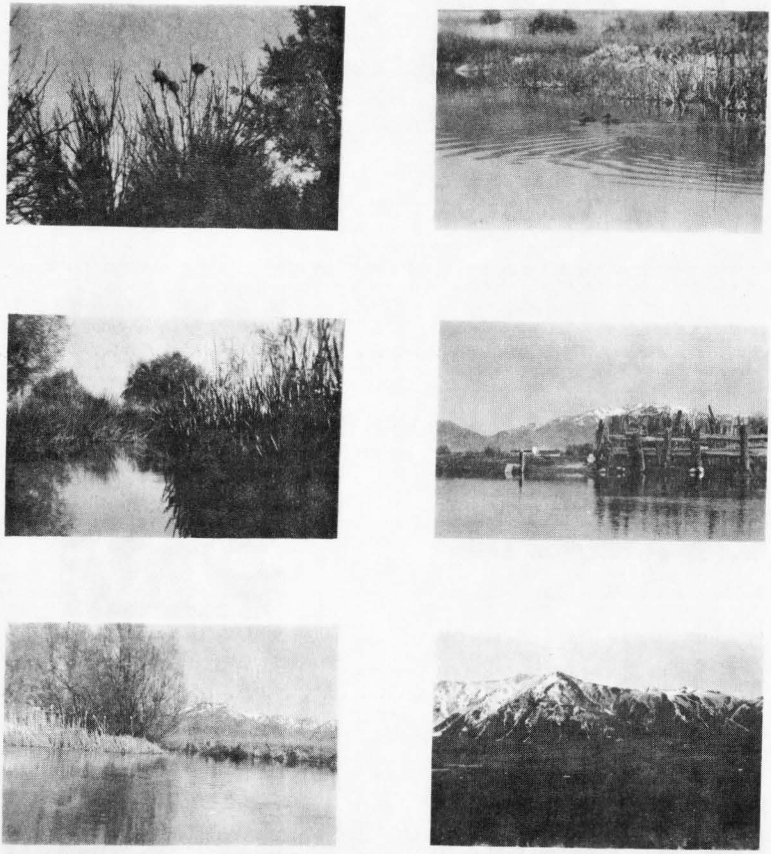
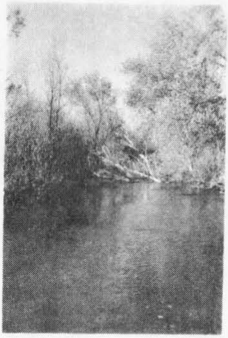


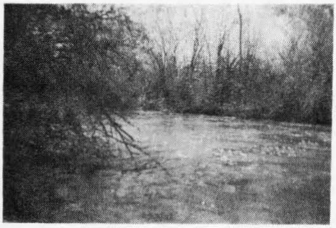
Figure 2. (continued)

LOGAN RIVER SETTING UNIT

Upper Waterscape Unit

Lower Waterscape Unit





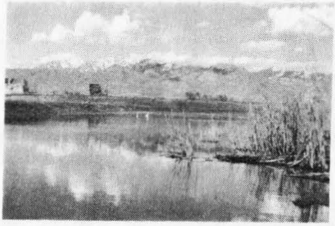


Figure 2. (continued)

MEANDERS SETTING UNIT

CENTRAL MARSH SETTING UNIT

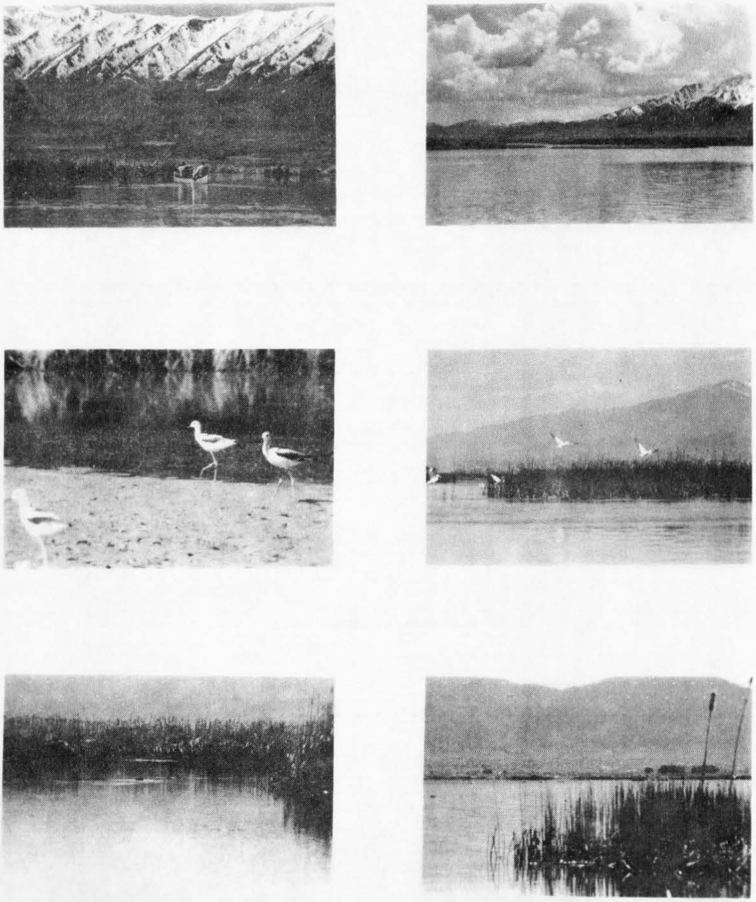
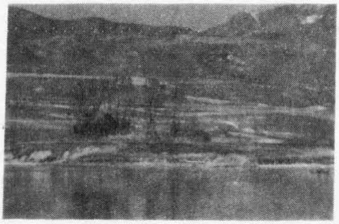


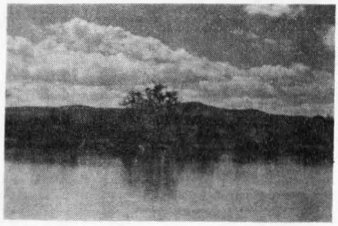
Figure 2. (continued)

NORTH MARSH SETTING UNIT

Upper Waterscape Unit

Lower Waterscape Unit





Clay Slough Waterscape Unit

Figure 2. (continued)

VITA

John C. Ellsworth

Master of Landscape Architecture

Thesis: Visual Assessment of Rivers and Marshes: An Examination of the Relationship of Visual Units, Perceptual Variables, and Preference

Major Field: Landscape Architecture

Biographical Information:

Personal: Born January 15, 1953 at Hot Springs, Arkansas, the second son of Thomas James and Julia Ellsworth.

Education: Attended Hot Springs High School, graduated in 1971. Attended Centenary College of Louisiana and the University of Arkansas at Fayetteville where requirements were completed in 1977 for the bachelor of arts degree in Natural Science. Attended graduate school in Landscape Architecture and Environmental Planning at Utah State University from 1978 to 1980; completed thesis requirements in Spring, 1982.

Professional Experience: Residential landscape designer; Project manager/landscape architect with private engineering consulting firm; Private consultant to coal surface mine planning; Project landscape architect on interstate highway construction with Colorado Division of Highways; Landscape architect on the Heber Ranger District of the Uinta National Forest; Teaching assistant for site construction, analysis, planning, and design at Utah State University; Lecturer on visual assessment at Utah State University.

Professional Publications:

Lodgepole Campground Expansion Environmental Analysis Report (U.S. Forest Service), 1978.

Facility Planning Study for Franklin Idaho--Draft, 1981.

A Visual Resource Inventory of Cutler Reservoir and its Tributary Streams, Cache County, Utah, 1980.

Visual Assessment of Rivers and Marshes: An Examination of the Relationship of Visual Units, Perceptual Variables, and Preference, 1982. (Master's Thesis)

Professional Associations:

International Erosion Control Association - member

American Society of Landscape Architects - associate member