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ABSTRACT

A rural land use project originated in the early 1970s when a landowner approached the University of Montana's Department of Geography asking for assistance in planning the use of more than 10,000 acres. The planning process evolved into four phases; the first three phases (biophysical assessment, capability analysis, and master planning) have been completed and Phase 4, site planning, is forthcoming. Biophysical assessment was the process of systematically defining characteristics of the land resource/environment as a basis for subsequent decision-making. Those data were then used in the capability analysis to assess ability of the resource to support various kinds of activities. Using the "relatively objective" capability assessment, the Master Plan evolved by evaluating appropriate use patterns through assessment of the suitability of specific parcels for various uses given cultural, economic, political, and environmental constraints. An integrated team-design approach was used in the Master Plan whereby social organization and supportive service elements were comingled utilizing land capability and sociological wisdom. While the planning did not develop a perfect system, it does demonstrate that economically and environmentally sound decisions are not mutually exclusive, particularly in rural areas where the unique ability exists to tailor land-use decisions to land capabilities and constraints. (BRR)

and others.[2] This paper is, instead, a brief look at a specific site-planning methodology adapted to a single planning problem in the rural West. While the specific techniques were developed for a particular situation and scale, the general methodological concepts should have wide applicability in rural regions of the U.S.[3]

Project History and Scope

The project originated in the early 1970s when a landowner approached the Department of Geography at the University of Montana asking for assistance in planning the use of slightly more than 10,000 acres of land that lay adjacent to the city of Helena, Montana (~~see Slide~~ 1). The area was under significant pressure for residential-type development because of its proximity to Helena. At the time, the land was used primarily for grazing, hay production, wildlife habitat and open space. The landowner's questions to the authors were "how does one determine the use capabilities of this land and how should one decide its future use?" This launched the *Land-Use Capability Study: Southeast Helena Project* and subsequent work that will be reported here.[4] Two years later, the study area was expanded considerably when the owner purchased an additional 2771 acre parcel adjacent to and east of the original area. This area is also shown on Figure 1 and resulted in the *Land-Use Capability Study: Lower Holmes Gulch Project*.[5] These slides should provide you with a feel for the environment in question. (Slides 2-6).

OVERVIEW OF PROCESS

At this point in time one would hope that he could demonstrate his omniscience by the eloquence of that moment in 1972 when he revealed the optimal solution to the problem and how he instituted a 10-year effort and others.[2] This paper is, instead, a brief look at a specific site-planning methodology adapted to a single planning problem in the rural West. While the specific techniques were developed for a particular situation and scale, the general methodological concepts should have wide applicability in rural regions of the U.S.[3]

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OVERVIEW OF PROCESS

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Figure 1 (Overhead 1) illustrates the format of this 10-year planning effort. For convenience, we will divide the process into 4 phases. The first three have been completed and are shown on this overhead:

Phase 1 -- Biophysical Assessment
Phase 2 -- Capability Analysis
Phase 3 -- Master Planning

Phase 4, site planning, and implementation is the next step to be taken.

These 4 phases represent the preconceived outline that guided our direction. Biophysical Assessment was the process of systematically defining the characteristics of the land resource/environment as a basis for subsequent decision-making. The biophysical data was then input into the Capability Analysis in order to assess the ability of the resource to support various kinds of activities. Using as a base the relatively objective capability assessments, the Master Plan evolved by evaluating the appropriate use patterns through assessment of the suitability of specific parcels for various uses given cultural, economic, political, and environmental constraints. The next step toward plan implementation will be to take the general patterns and development criteria defined by the Master Plan and develop detailed site plans and time-phasing plans.

Biophysical Assessment

In the Biophysical Assessment phase a major goal was to develop a data base that adequately defined the ecological relationships of the study area

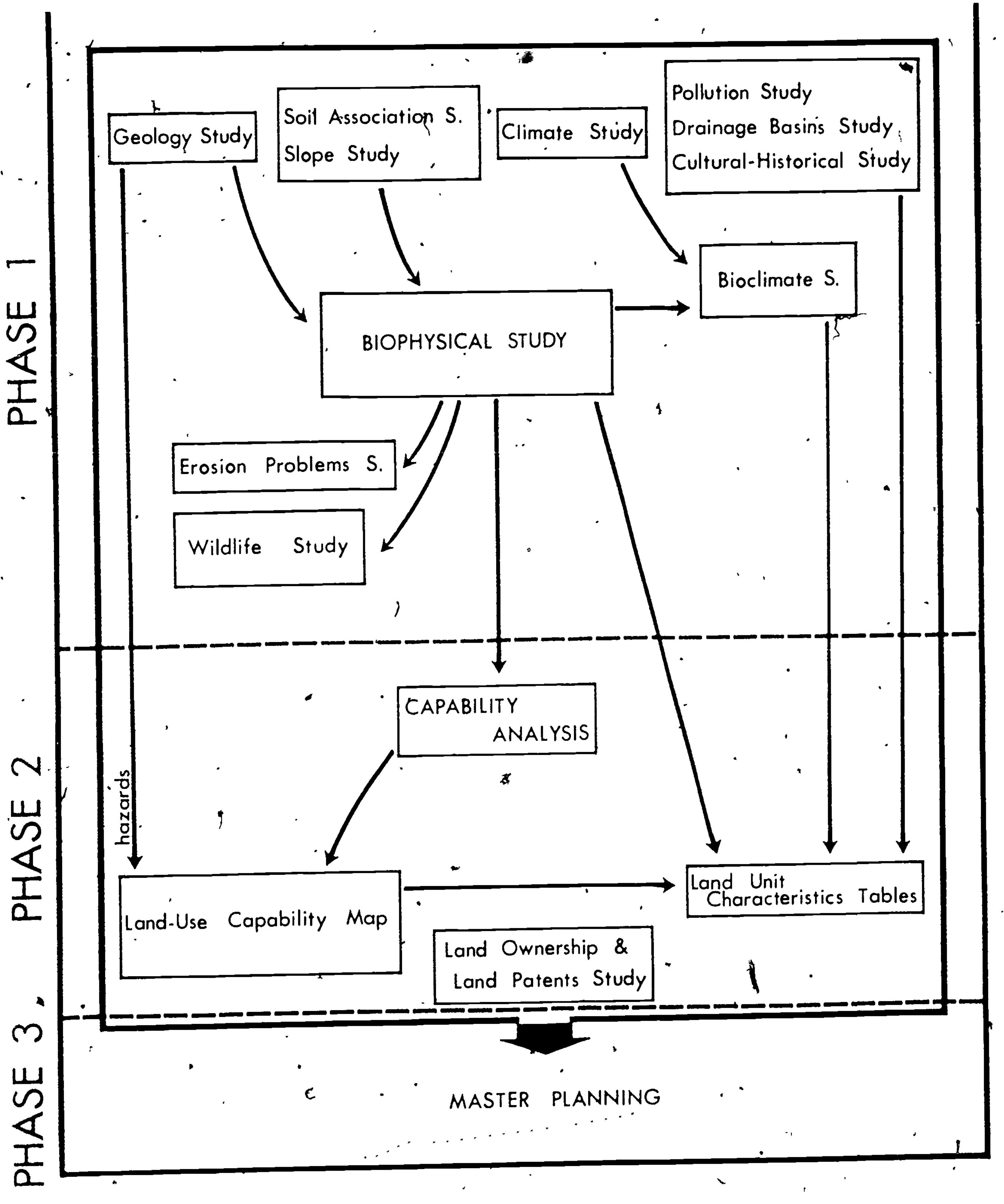

Figure 1: Study Organization

as well as the other human or environmental characteristics that affected the land resource. This data base was necessary for interpreting a variety of potential uses: e.g., residential or commercial development, wildlife production, grazing, and forestry. The biophysical studies were the cornerstone of this phase.[6]

The building blocks of the biophysical studies were the biophysical units (slide 7). The biophysical unit is a homogeneous land unit based on site associations (soil associations plus slope), present vegetation, and potential vegetation. These components are represented by the composite symbols found on the biophysical maps. However, there are other ecosystem components which are implicit in a biophysical unit. Geology and geomorphology are reflected by the soil association units. Water or humidity is reflected in the type and productivity of the potential vegetation community. In addition, wildlife is included in that the biophysical units form part or all of the habitats of various species. Although the implicit elements are not included in the map symbol, they are described in the text of the study.

The biophysical unit, either explicitly or implicitly, includes many of the principal physical components which should be considered in land-use planning. Site association data provide essential information regarding engineering aspects of sites. Present vegetation is important in terms of short-term planning and is an indicator of past modification and present conditions. Potential vegetation has indicator value with regard to climate and site productivity and is important in long-term planning or management decisions. Evaluation of the entire biophysical unit provided the bulk of the information needed for immediate management programs (e.g., erosion control, grass seeding, tree thinning, etc.).

For some purposes, biophysical units were too small and too numerous to handle individually. Therefore, biophysical regions were determined by aggregating biophysical units. These regions are broadly uniform in topography and vegetation. A biophysical profile was produced for each region (slide 8). The profile was designed to give the reader an overall view of the character of the region. Included in the profiles were all of the site association types, profiles on each of the principal soil series, and a representation of some of the present vegetation communities. It is important to note that this is a diagrammatic profile and not a real cross-section of the actual sequence of units across the region. This method of presentation depicted the principal regional components and alleviated the need to develop a burdensome number of cross-sections to achieve the same end.

The primary output of each biophysical study was a "Biophysical Map" (slide 9) and descriptive text. In order to facilitate future analysis, the data on the Biophysical Maps were organized using two different legends:

1) site associations legend with soils and slope depicted (shown here), and
2) vegetation legend with potential and present vegetation depicted (slide 10).

This was a systematic attempt to identify and describe the ecological relationships of the site for multiple management decision-making. As shown on Overhead 1 there were also a number of other products of the Biophysical Assessment phase:

1) The Geology Study and map provided an explicit discussion of the geologic data implicit in the biophysical units. (Slide 11) Hazard data (e.g., fault zones) was input directly in the Capability Analysis phase. (Overhead 1)

2) The Soil Association Study and map provided base data for the Biophysical Study. (Slide 12)

3) The Slope Study and map provided base data for the Biophysical Study. (Slide 13)

4) The Climate Study led to the development of a Bioclimate Study using the potential vegetation data of the Biophysical Study. (Slide 14)

5) The Erosion Problems Study was a direct offshoot of the Biophysical Study fieldwork. (Slide 15)

6) The Wildlife Study was a direct result of the Biophysical Study (habitat analysis) and population sampling. (Slides 16, 17)

7) The Pollution Study evaluated air pollution impacts of off-site sources. (Slide 18)

8) The Drainage Basins Study was used as the planning and time-phasing framework. (Slide 19)

9) The Cultural-Historical Study focussed on the current and relic human activities of the site that might influence future land-use decisions. (Slide 20)

Capability Analysis

The second phase of the project was to develop a Capability Analysis in order to identify and describe the ecological constraints to structural development. From this point, the land-use focus shifted to the problems associated with urban-type developments. However, the descriptive text of the biophysical studies did discuss issues such as range productivity, erosion, wildlife habitat, and forest management. Those data have been used extensively in developing management plans for areas identified as not capable or suitable for development and for areas where structural development remains only dimly possible.

The first step in the Capability Analysis was to assess the site associations (soil plus slope units) data as to the constraints for structural development. This process is illustrated by the Site Association, Land-Capabilities and Constraints tables an example of which is shown in Slide 21. The primary factors used in delineating a capability potential were slope; road construction, maintenance, and safe use problems; septic problems;

stability problems; excavation problems; seismic response problems and water pollution potential. Based on a somewhat subjective notion of what one would be willing to pay to overcome these problems, we assigned each biophysical unit one of five capability classes from D1 (virtually no problems) to M (highly sensitive or fragile areas). In some areas there was enough variation in the soils characteristics embodied in the soil associations data that the single capability class masked the capability range. In these cases we identified the units according to the most limiting soils and denoted them with a prime (e.g., D2' or R') indicating that with more detailed soils data a better development potential may be shown to exist. (Slide 22)

Step two was the production of a Capability Map shown in Slide 23. After each biophysical unit was evaluated, the resulting capability classes were aggregated and mapped. For analytical purposes, the map was divided into drainage basins and each map unit within a capability class was identified by a number. For example, in a single drainage basin we may have found 5 map units defined as D1. These would be identified as 1D1, 2D1, 3D1, 4D1, and 5D1. The process was repeated for each class and for each drainage basin. The result was the ability to reference each map unit.

In the final step of the Capability Study, a table was produced for each drainage basin which summarized the relevant capability concerns for each of the capability map units just defined. This is shown in Slide 24, Land Unit Characteristics: Martinez Gulch Drainage Basin. As one can see, the table describes non-engineering characteristics: present and potential vegetation, vegetation condition, bioclimate, present wildlife habitat, cultural-historical features, access, aesthetics and management concerns. In retrospect, one of the major omissions of this table was a column which explicitly detailed alternative capabilities (e.g., poor agriculture potential or good grazing potential, etc.).

One important factor to keep in mind is that the Capability Map represents a rather narrow assessment of the level of structural development that could take place on a particular capability unit. It does not assess what should take place because it ignores important suitability factors such as accessibility, spatial arrangement (design), and cumulative or synergistic effects. These are the concerns of the next study phase. Two additional studies that were completed in this Phase 2 were the Land Patents (Slide 25) and Land Ownership Studies (Slide 26). Each has obvious implications for land-use decision-making.

Master Planning

The work exemplified by the Master Planning Phase was directed by a geographer but represents the integral participation of a wide range of specialists: a planner, a wildlife specialist, an historian, architects, urban design specialists, recreation planners, graphic specialists, and engineers. The Crossfire Master Plan represents only that portion of the original study areas which are under the greatest pressure for urban-type development and is shown in Slide 27.[8]

In general, the purpose of the Master Planning phase was to develop a community design based on the capabilities of the "natural" environment yet organized to provide a new, healthy "human" environment. Specifically, seven goals were proposed (Slide 28):

1) provide for stable economy and self-supportive tax base in employment and investments;
2) provide an integrated variety of life;
3) integrate the work place and the home and decrease social, economical, and environmental costs;
4) provide a safe and healthy living environment for all ages by eliminating hazards and by promoting awareness of the natural and man-built environment for sound mental and physical health;

5) increase opportunities for social interaction, political participation, economic responsibility, and environmental sensitivity;
6) develop well-defined representations of desirable social values, (e.g., sense of neighborhood, feeling of belonging, etc.), and
7) set standards of excellence for community living which will provide a high quality product at a competitive price.

An integrated team-design approach was used in the Master Plan phase whereby the social organization and supportive service elements were comingled utilizing land capability and sociological wisdom. (Slide 29) The social organization and thus the community is hierarchical in nature: families → clusters → subneighborhoods → neighborhoods → community.

The supportive services represent the standard services required for any community to function: workplaces, open space, transportation, community core, schools, churches, water supply and sewage disposal. Design criteria, as illustrated in Slide 30, were enumerated for each of the social organization and supportive services elements prior to the design/spatial organization stage. For example, the design criteria for the cluster level of social organization included seven points where each cluster should:

1) be clustered in groups of 3 to 12, with 8 to 21 units being preferred
2) have commonality in design, structure type, size, ownership pattern and open space
3) provide pedestrian traffic patterns which do not create conflict or intrusion
4) encourage strong interaction in each cluster
5) enhance interaction with other clusters by such means as bus stops, pathways, services, and common greens
6) provide small common greens to serve as a focal point for the dwelling units, a playground for preschool children, a meeting place for adults and children, a sitting area for conversations, and a gathering place for events, picnics, parties, or games
7) encourage each dwelling unit to have only one main entrance equally accessible from vehicular and pedestrian access, a frequently-used room (kitchen, family room) oriented toward common green for visual control of preschool play area from dwelling units; and a south-facing court, garden or yard, integrated into the flow of activities of the dwelling unit itself.

The primary output of the Crossfire Master Plan was a map and description of the design principles. Slide 31 is the Crossfire Master Plan Map showing 15 map units:

1. Natural Areas
2. Common Greens/Pedestrian Paths
3. School/Park
4. Golf Course
5. Aquatic Resource
6. Other ownership
7. Roads by Type
8. Single family (2-4 Dwelling Units/acre)
9. Single family (4-8 DU/ac)
10. Single family (8-16 DU/ac)
11. Multiple Family (16-24 DU/ac)
12. Multiple Family (24-48 DU/ac)
13. Community Core
14. Major Commercial
15. Major Work Place

The next phase of this evolving planning process is to utilize the capability base data, master plan, and design criteria in site design and implementation. This is being done at this time.

Summary

In 1972 a planning process was inaugurated that utilized basic resource/ecological data in subsequent land use design and management decisions. As illustrated here, each planning stage utilized data produced in all previous stages. While not a perfect system, it is hoped that it demonstrates that economically and environmentally sound decisions are not mutually exclusive. In rural areas, in particular, we have the unique ability to tailor land-use decisions to land capabilities and constraints. Maintaining the integrity of the land resource base is especially important in rural areas where the land resource is central to local economic and social health.

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[6] Carlson, Land-Use Capability Study, App. A; Denney, Land-Use Capability Study, App. A.

[7] Ibid.

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