Landscape Ecology vol. 1 no. 4 pp 213-226 (1988)
SPB Academic Publishing bv, The Hague

Landscape planning: a working method applied to a case study of soil conservation

Frederick R. Steiner[1] and Douglas A. Osterman[2]
[1]Center for Built Environment Studies, University of Colorado at Denver, 1200 Larimer Street, UCD Box 128, Denver, CO 80204 USA; [2]Palouse Conservation District, NE 1325 Terre View Drive, Suite 1, Pullman, WA 99163 USA

Keywords: landscape ecology, soil erosion, agroecology, grassland, Palouse, Washington watershed

Abstract

A working method for landscape planning is proposed. There are 11 steps in this method. In step one, an issue (or set of related issues) is identified as posing a problem or an opportunity to people and/or the environment. In step two, a goal (or several goals) is established to address the problem. In steps three and four, ecological inventories and analyses are conducted at two scales, first at the regional level (drainage basins are suggested as an appropriate unit) and then at the landscape level (watersheds are recommended). These inventories and analyses consider human ecology as well as bio-physical processes. Step five involves detailed studies, such as suitability analyses, that link inventory and analysis information to the problem(s) and goal(s). In step six, concepts are developed that lead to a landscape (watershed) master plan in step seven. During step eight, the plan is explained through a systematic educational effort to the affected public. In step nine, detailed designs are developed. In step 10 the plan and designs are implemented. Step 11 involves administering and monitoring the plan. The method is explained through an example of soil conservation planning. The case study was undertaken in the Missouri Flat Creek watershed of the Palouse region in the Pacific Northwest (U.S.A.) to help achieve the goals for erosion control established by the federal Food Security Act of 1985 and state clean water legislation.

Introduction

This paper is based on the thesis that for landscape planning to make a meaningful contribution to society, there must be a method which can be applied to diverse settings and situations. Such a method must be iterative yet flexible. There will be no discussion about the need for landscape planning: the assumption being made that readers of this journal recognize its necessity. One need only to read a newspaper almost anywhere in the world to be aware that humans are placing strains on the environment that threaten the long-term sustainability of the planet.

The definition used here for landscape planning is based on Alexander Pope's advice 'to consult the genius of the place'. Information about the place, its landscape, is used to provide choices for people. The landscape is the medium for change by people, who are the agents of change. The landscape is dynamic: a latent landscape (or one to be) as well as a manifest landscape (or one that is). Landscape planning is the process of choice based on knowledge about people and land. Since human and natural processes are interacting, they are ecological, and hence there is a strong ecological or, more specifically, human ecological bias to the method presented here. Gerald Young has suggested that

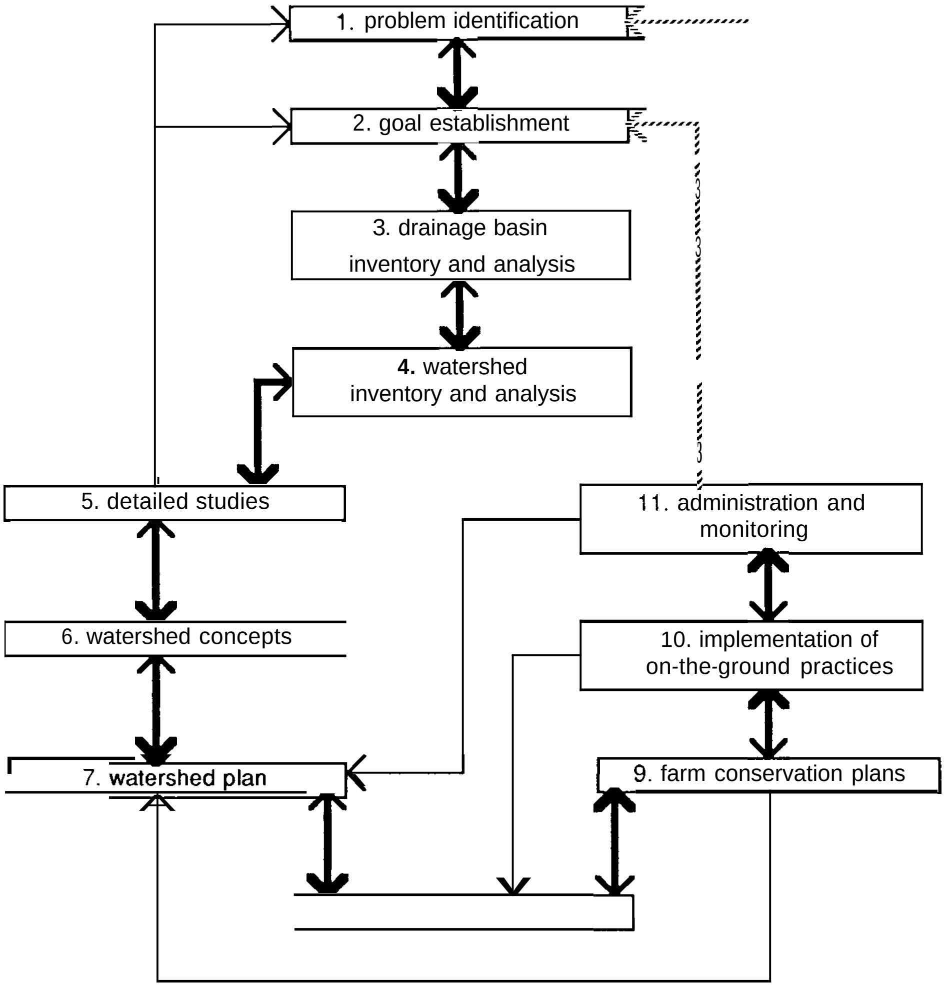


Fig. 1. **Landscape Planning Working Method for Soil Conservation (derived from Steiner and Brooks 1981, and Duchhart *et al.* 1988).**

'human ecology may be defined **(1)** from a bio-ecological standpoint as the study of man as the ecological dominant in plant and animal communities and systems; **(2)** from a bio-ecological standpoint as simply another animal affecting and being effected by his physical environment; and **(3)** as a human being, somehow different from the animal life in general, interacting with the physical and modified environments in a distinctive and creative way. **A** truly interdisciplinary human ecology will most likely address itself to all three' **(1983,** pp. **359–360).**

The method has evolved from the experience of the authors and their collaborators in the Pacific Northwest (Steiner and Brooks **1981;** Steiner **1987a;** Steiner *et **al.*** **1988;** Osterman *et **al.*** **1988)** and the Netherlands (Duchhart *et **al.*** **1988).** The inspiration for the method comes from the writings of Geddes (Stalley **1972;** Boardman **1978),** Mumford **(1961),** Leopold **(1933),** and McHarg **(1969).** The method (Fig. **1)** is based on the philosophy that in order to create or to protect sustainable landscapes, an integrated approach is necessary. It attempts to integrate information about bio-physical and socio-cultural systems at different scale levels ranging from the regional to the individual. The method proposed here has been influenced by conventional planning processes (see Hall **1975;** Roberts **1979;** McDowell **1986,** and many others) as well as those suggested specifically for landscape planning (Lovejoy **1973;** Fabos **1979;** Zube **1980;** Marsh **1983).** Unlike some of these other planning processes, design plays a central role in this method.

As summarized in Fig. 1, there are 11 interacting steps. An issue or group of related issues is identified in the first step. These issues are problematic or present an opportunity to the people and/or the environment of a region. A goal(s) is then established in the second step to address the problem(s). Next, in steps three and four, inventories and analyses of bio-physical and socio-cultural processes are conducted, first at larger level, such as a drainage basin or an appropriate regional unit of government and second at a more specific level, such as a watershed or local government. Drainage basins and watersheds are used for this discussion.

In step five, detailed studies are made that link the inventory and analysis information to the problem(s) and goal(s). Suitability analysis is one type of detailed study (McHarg 1969; Steiner 1983). Step six involves the development of concepts at the watershed level. A landscape master plan is then derived from these concepts in the seventh step. This watershed plan is explained in a systematic educational effort to the affected public during step eight. In step nine, detailed designs are made that are specific at the individual land-user level.

These designs and the plan are implemented in the 10th step. In step 11, the plan is administered and monitored. The heavier arrows in Fig. 1 indicate the flow from step one to 11. Smaller arrows between each step suggest a feedback system whereby each step can modify the previous step and, in turn, change from the subsequent step. Additional arrows indicate other possible modifications through the process. For instance, detailed studies of a watershed (step five) may lead to the identification of new problems or the amendment of goals (steps one and two). Detailed designs (step nine) may change the watershed plan and so on. Once the process is complete and the plan is being administered and monitored (step 11), the view of the problems facing the region and the goals to address these problems may be altered, as is indicated by the dashed lines in Fig. 1. Each of these steps will be described in more detail through the use of a case study in conservation planning from the Palouse region of Washington and Idaho (U.S.A.).

1. Step one: problem and opportunity identification

Human societies face many social, economic, political, and environmental problems and opportunities. Since a landscape is the interface between social and environmental processes, landscape planning addresses those issues that concern the interrelationship between people and nature. The planet presents many opportunities for people, and there is no shortage of environmental problems. The case study involves a serious natural resource degradation issue.

The Missouri Flat Creek Watershed Conservation Plan (MFCWCP) concerns the problem of soil erosion. Soil erosion poses a major threat to the long-term sustainability of agriculture. Erosion is a problem in many rural regions of the United States and around the world. In addition to its negative impacts on agriculture, erosion degrades water quality and wildlife habitat. Roads, recreational facilities, and homes can be damaged by erosion.

The costs of erosion are substantial. According to Pimental *et al.* '... soil erosion and associated water runoff cost the United States about $43.5 billion annually in direct and indirect effects' (1987, p. 281). Further, they observe that the 'long-term environmental and social costs may be several times this level' (Pimental *et* al., p. 281). Lee, based on 1982 National Resources Inventory (NRI) data, has found that '... erosion on 44% of all (United States) cropland exceeds T (tolerable levels) ... (and in 14 regions) where cropland accounts for at least 30% of the rural land base, average (annual) erosion rates on cultivated cropland are at least 10 tons per acre' (22.4 metric tons/ha) (1984, p. 228).

Soil erosion is an especially serious problem in the Palouse region of eastern Washington and northern Idaho: it is one of the 14 serious areas identified by Lee (1984) from NRI data. The Missouri Flat Creek watershed is located in the Palouse River drainage basin (Fig. 2). According to the U.S. Department of Agriculture (USDA), since 1939, total erosion on cropland in the Palouse River drainage basin has averaged 360 tons per acre (806.4 metric tons/ha) (USDA 1978). On some steep slopes, annual soil losses of 100 to 200 tons

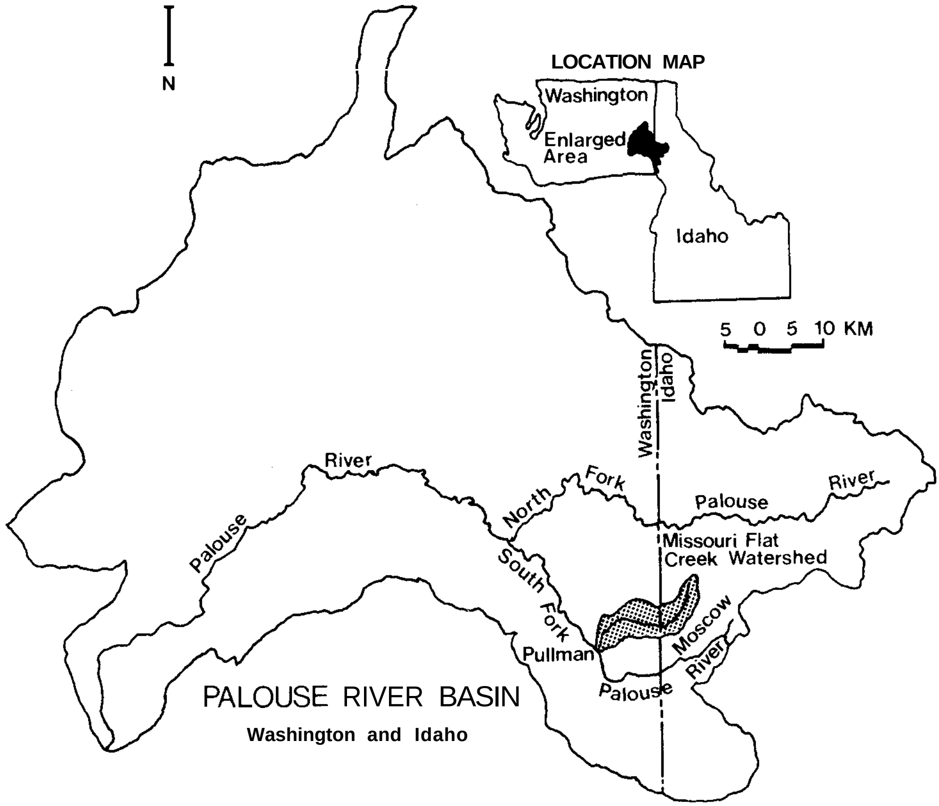


Fig. 2. The Location of the Missouri Flat Creek Watershed within the Palouse River Drainage Basin (from Osterman 1987b).

per acre (224 to 448 metric tons/ha) frequently occur (USDA 1978). In the central part of the Palouse basin, average annual erosion rates are 20 tons per acre (44.8 metric tons/ha) (USDA 1978). All of the original topsoil has been lost from 10% of the cropland in the basin and one-fourth to three-fourth has been lost from another 60% (USDA 1978). As noted by the USDA, 'silt (from erosion) smothers crops in bottomland areas, and it fills stream channels, waterways, and drainage ditches, increasing flood problems' (1979, p. 8). Suspended sediment from soil erosion in the Palouse River is carried into the Snake and Columbia Rivers 'where it fills reservoirs of hydroelectric plants, destroys fish habitats, ruins recreation areas, and pollutes other water, making them unfit for many uses' (USDA 1979, p. 8). The economic and environmental costs are substantial. Approximately 17 million tons of soil per year are currently lost from the Palouse threatening its long-term sustainability. Each year one rural Palouse county, Whitman, spends $500,000 to $1.6 million to repair roads from the impacts of erosion (Steiner 1987a). Another one million dollars is spent in the basin annually cleaning silt from highway ditches. The U.S. Army Corps of Engineers has proposed a plan which would cost more than $4 million per year just to dredge the sediment from one segment of the Snake River. The U.S. Soil Conservation Service (SCS) expects soil erosion to increase in the Palouse unless farming systems change.

2. Step two: goal establishment

Goals articulate an idealized future situation. In the context of this method, it is assumed that once goals have been established there is a commitment by some group to address the problem or opportunity identified in step one. Problems and opportunities can be identified as various levels. Local people can recognize a problem or opportunity and then set a goal to address it. As well, issues can be international and/or global in scope. Problem solving, of which goal setting is a part, may occur at many levels or combinations of levels. Although goal setting is obviously dependent on the cultural-political system, the people affected by a goal should be involved in its establishment. Herbert Gans advocated a goal-oriented approach to planning which he explained in the following way

> The basic idea behind goal-oriented planning is simple; that planners must begin with the goals of the community – and of its people – and then develop those programs which constitute the best means for achieving the community's goals, taking care that the consequences of these programs do not result in undesirable behavioral or cost consequences (1968, p. 53).

Often, the goals of a community become entwined with state and federal policy. The conservation of soil has been a matter of American public policy since the 1930s. However, past conservation efforts have not been effective in controlling erosion. During the Great Depression, in response to the severe crisis in American agriculture, a series of federal laws were enacted as part of President Roosevelt's New Deal. These laws were designed to improve the agricultural economy and to control erosion. The Soil Conservation Act of 1935 created the SCS and established a national goal 'to provide permanently for the control and prevention of soil erosion and thereby to preserve natural resources, control floods, prevent impairment of reservoirs, and maintain the navigability of rivers and harbors, protect public health, public lands and relieve unemployment'.

To achieve this goal, a mandatory approach to land-use planning was contemplated by the Roosevelt administration. When such an approach proved to be politically unfeasible, a voluntary land-use planning system was adopted. This system relies on state-level conservation commissions and local conservation districts. Farmers and other land users enter into voluntary agreements with the local districts to manage erosion through farm-level conservation plans. The SCS provides technical assistance in the preparation of these plans.

The system, combined with other programs such as the Soil Bank of the 1950s and 1960s, achieved some conservation results. But, during the 1970s, after the grain sales to the Soviet Union and the People's Republic of China, many farmers abandoned their conservation measures at the urging of then Secretary of Agriculture Earl Butz of the Nixon and Ford administrations. Rates of soil erosion increased. The pervasiveness of the problem was made evident through the 1977 and 1982 NRIs conducted by the SCS.

Growing concern about these rates of erosion resulted in the adoption of strong conservation provisions by the U.S. Congress as part of the Food Security Act (FSA) of 1985. This act is the most important soil conservation legislation since the 1930s and has the potential to have the most significant impact on the use of privately owned agricultural land of any federal law since the Homestead Act of 1862. Farm-level conservation plans are no longer strictly voluntary. The FSA requires land users to have a conservation plan on highly erodible land in order to remain eligible for federal agricultural program benefits. Between 1988 and 1990, the USDA estimates that about 800,000 conservation plans will need to be produced (Myers 1988). These new provisions encourage cross-compliance between federal agricultural and conservation programs. According to the USDA (1986), the goals of the FSA include the control of soil erosion, the retention of wetlands, and the reduction of surplus agricultural commodities. The new provisions are known as the conservation reserve, conservation compliance, sodbuster, and swampbuster and have been described as follows (as adapted freely from USDA 1986):

> ***Conservation reserve:*** The conservation reserve offers producers help in retiring highly erodible cropland. The Agricultural Stabilization and Conservation Service (ASCS) will share up to half of the cost of establishing permanent grasses, legumes, trees, windbreaks, or wildlife plantings on highly erodible cropland as identified by the SCS. Under 10-year contracts, ASCS will make annual rental payments as long as the terms and conditions of the contract are met.

Conservation Compliance: Conservation compliance applies if farmers continue planting annually tilled crops on highly erodible fields. To remain eligible for certain USDA program benefits (including price and income supports, crop insurance, Farmers Home Administration loans, Commodity Credit Corporation storage payments, and farm storage facility loans), farmers must develop and be actively applying a locally approved conservation plan for highly erodible fields by January 1, 1990 and have the plan implemented by January 1, 1995.

Sodbuster: Sodbuster applies if a highly erodible field is planted with annually tilled crops that was not used for crop production during the period 1981–1985. If a highly erodible field is plowed, then it must be done under a conservation system approved by the local conservation district in order for the farmer to remain eligible for USDA program benefits.

Swampbuster: Swampbuster applies if a land user converts naturally occurring wetland to cropland after December 23,1985 (the date when the FSA was signed by President Ronald Reagan). With some exceptions, to remain eligible for certain USDA farm program benefits, farmers must discontinue production of annually tilled crops on newly converted wetlands.

Several state governments have also enacted measures to control erosion. Concurrently, water quality, including degradation resulting from soil erosion, has received greater attention from policymakers. The U.S. Congress and several state governments, including Washington state, enacted new clean water legislation from 1984 to 1988. A major goal of these new initiatives was the control of non-point-source pollutants, including those from soil erosion.

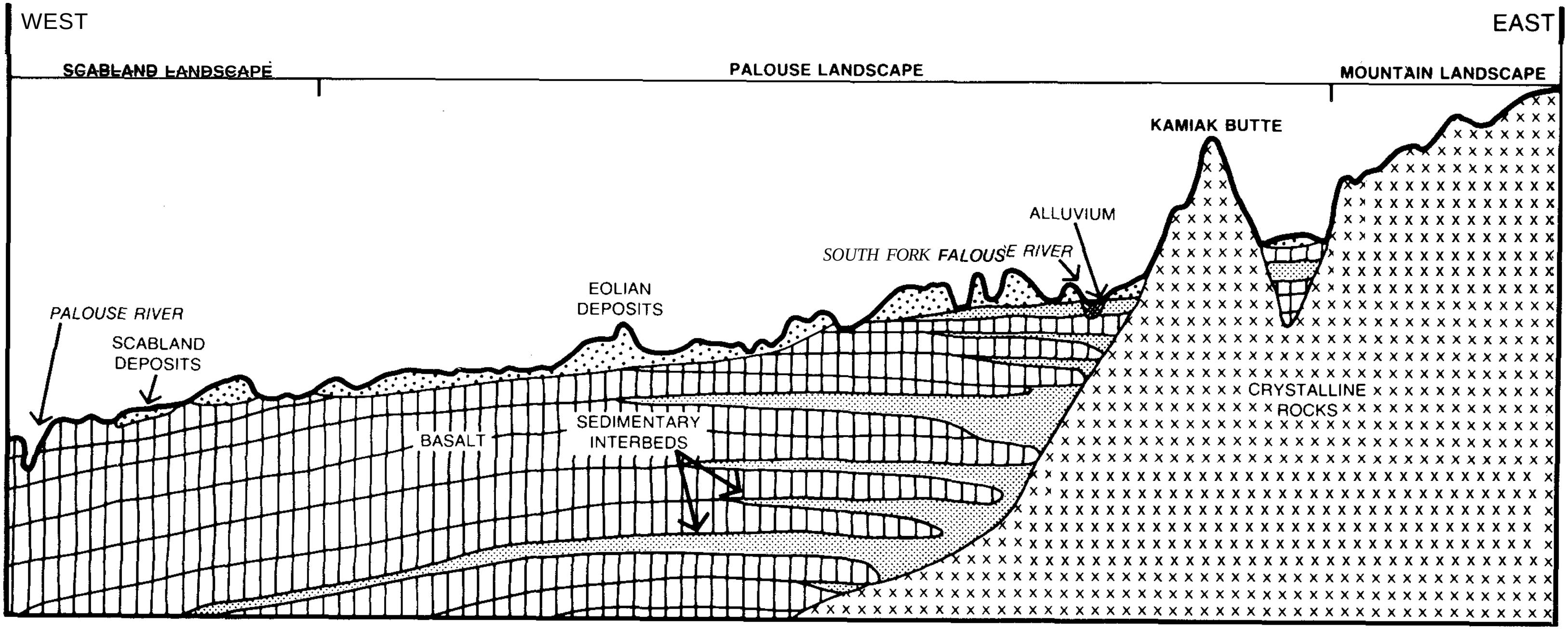
Federal and state goals were recognized locally in the Palouse region, which has been the location of numerous soil conservation efforts since the 1930s (see USDA 1978). Beginning in 1984, the local office of the SCS and the Palouse Conservation District began to sponsor a series of watershed-level ecological inventories including one of the Missouri Flat Creek (Barrett *et al.* 1985). The Palouse Conservation District is a special purpose, local governmental entity, responsible for soil conservation. The district is administered by a board of supervisors who are elected from among local land users. All of the Palouse district supervisors are farmers. The district received a grant from the Washington Department of Ecology to sponsor the MFCWCP. The goal of the project was to develop a plan for the watershed so that the new federal, soil conservation requirements of the FSA could be met while addressing state and federal water quality concerns.

3. Step three: landscape analysis: regional level

This step and the next one involve interrelated scale levels. The method addresses three scale levels: drainage basin, watershed, and individual land parcel, with an emphasis on the watershed. Lowrance *et al.* (1986) have suggested a hierarchial approach is helpful for work related to sustainable agriculture. Drainage basins and watersheds have often been advocated as useful levels of analysis for landscape planning and natural resource management (Young *et al.* 1983; Dickert and Tuttle 1985; Dickert and Olshansky 1986; Steiner 1983; Easter *et al.* 1986, and Fox 1987).

Essentially, drainage basins and watersheds are the same thing (catchment areas), but, in practical use, especially in the United States, drainage basins generally refer to larger regions and watersheds to more specific areas. In their hierarchy Lowrance *et al.* (1986) refer to watersheds as the landscape system or ecologic level and the larger unit as the regional system or macroeconomic level; the two smallest units are the farm system or microeconomic level and the field system or agronomic level. The analysis at the regional, drainage basin level provides insight into how the landscape functions. The study area's location and landscape forming phenomena (climate, geology, physiography, hydrology, soils, vegetation, wildlife, and people) are analyzed.

The SCS has utilized drainage basins and watersheds in planning since the 1930s, and has had an active small watershed program since the 1950s.



SCHEMATIC EAST-WEST GEOLOGIC SECTION THROUGH SOUTHERN WHITMAN COUNTY
ADAPTED FROM WALTERS AND GLANCY, RECONNAISSANCE OF GEOLOGY AND OF GROUNDWATER OCCURRENCE IN WHITMAN COUNTY, WASHINGTON (1969), p.4.

Fig. 3. Schematic East-West Geologic Section Through Southern Whitman County, Washington (adapted from Walters and Glancy 1969, and Steiner 1987a).

Drainage basin inventories were mandated by Section 209 of the Federal Water Pollution Control Act Amendments of 1972. Since the 1930s, the SCS has used bio-physical and land-use inventories and analyses for conservation planning at the drainage basin, watershed, and individual farm levels.

Because of these precedents, conservation planners are familiar with inventories and analyses of drainage basins and watersheds. A systematic landscape planning method can be helpful to link broader regional level information to more detailed data at the watershed level; parts can be analyzed to reveal more about the whole, and vice versa. In the Palouse, a drainage basin inventory and analysis was conducted (Steiner 1987b) which builds on a number of ecological inventories that have been undertaken in the region since 1977.

The inventory revealed that the region is both highly productive agriculturally and highly erodible. The semi-arid Palouse River drainage basin covers some 810,000 ha in eastern Washington and northern Idaho in the Pacific Northwest of the United States. The basin has been settled for a little over a hundred years first by ranchers and later by farmers. The headwaters of the Palouse River are in the Idaho mountains. The river flows some 200 km before reaching its mouth at the Snake River, after tumbling over the 56.4-m Palouse Falls.

The Palouse River flows through three distinct landscapes, as an east-west cross-section of the basin (Fig. 3) illustrates. The highest, eastern elevations, the mountain landscape, are comprised of the oldest geologic formations (crystalline rock) and have the most precipitation. The mountain landscape is forested, rocky, and steep. The middle, or Palouse, landscape is underlain with basalt and covered with loess. The native vegetation of this landscape was grass, and it is now dominated by soft winter white wheat ***(Triticum aestivum*** L.). The lowest, western elevations, scabland landscape, were formed by glacial floods and are rather barren.

The middle landscape dominates the basin and is an important agricultural region. The Palouse landscape resembles vegetated sand dunes. There are three precipitation zones within this landscape (USDA 1978). Farming practices, agricultural productivity, and erosion rates vary with the precipitation and soil type. Most of the precipitation occurs in the winter in the form of snow. Many farmers keep their fields bare in the winter to capture moisture. This exacerbates the erosion problem when warm winter winds, called Chinooks, melt the snow rapidly. The runoff removes the unprotected soil. The middle precipitation zone (38.1 –45.7 cm annually) has the most severe erosion. In this zone some 44.8 metric tons/ha of soil are eroded annually. The other zones also have rates of erosion that threaten the long-term agricultural productivity of the region.

4. Step four: landscape analysis: watershed level

During this fourth step, processes taking place in the area are studied. The major aim of watershed-level analysis is to obtain insight about the natural processes and the human plans and activities. They are viewed as the elements of a system. The landscape can be seen as a visual expression of this complex system. Thus, ‘reading’ the landscape will illuminate much of the system.

The Palouse basin study was followed by a more specific inventory and analysis of the Missouri Flat Creek watershed conducted by the planning team which was organized as a result of the Department of Ecology grant (Osterman 1987a and 1987b; Osterman and Hicks 1988) (Fig. 2). The planning team recorded information about topography, soils, land use, land ownership, and non-point-source pollution on mylar base maps. The watershed is in the middle landscape area (Fig. 3) and contains approximately 27 square miles with 36 farms. Farmers produce winter and spring wheat, barley, dry peas, and lentils. Other, more minor land uses include rangeland, forest land, and built-up land. Sheet and rill erosion rates on dryland cropping areas in the watershed are among the highest in the nation, making it a highly erodible area within a highly erodible region. In this regard, the erosion problems in the watershed may be viewed as symptomatic of those in the larger region. Sheet and rill erosion displaces 201,500 to 232,500 tons of soil in the watershed each year (USDA 1978). The sediment delivery rate to streams is 25–45% of the soil washed from the fields, resulting in 50,375 to 104,625 tons of sediment per year (USDA 1978). The erosion season is November through March. Ninety-seven percent of the soils are highly erodible in the watershed according to FSA standards established by USDA (Osterman 1987a and Osterman and Hicks 1988).

5. Step five: detailed studies

Detailed studies link the inventory and analysis information to the problem(s) and goal(s). One example of such studies is suitability analysis. As explained by McHarg (1969), suitability analyses can be used to determine the fitness of a specific place for a variety of land uses based on thorough ecological inventories and on the values of land users. The basic purpose of the detailed studies is to gain an understanding about the complex relationships among human values, environmental opportunities and constraints, and the issues being addressed. To accomplish this, it is crucial to link the studies to the local situation. As a result, various scale levels may be used.

In the MFCWCP, an analysis of current farming systems was conducted so that these practices could be understood in the environmental context of the watershed. The practices were related to the erosion and water quality problems and, thus, the goals to ameliorate these problems. As part of this effort, a survey of farmers in the watershed was conducted to gain an understanding of their attitudes toward soil erosion and the conservation provisions of the FSA (Osterman and Hicks 1988). The USDA regulations establish specific criteria for identifying highly erodible land. The survey revealed a significant difference between the land the farmers perceived to be highly erodible and those lands defined as highly erodible by USDA. This misperception is a contributing factor to the erosion problem in the watershed. Farmers are not aware of how serious erosion is on their land and thus do not take steps to control it. Because they do not recognize the amount of their own highly erodible land, they could lose federal agricultural benefits if they do not adopt a conservation plan (Steiner *et al.* 1988). All farmers in the watershed currently participate in federal programs.

To underscore this gap, the highly erodible lands, as defined by FSA regulations, in the watershed were identified and mapped (Osterman 1987b). According to the federal regulations implementing the FSA, highly erodible land is based on the Universal Soil Loss Equation (USLE) or the Wind Erosion Equation (WEE), and tolerance levels (T). The USLE is expressed as $A = RKLSCP$, where

A = the estimated average soil loss in tons/acre/year;
R = the rainfall and runoff factor;
K = the soil erodibility factor;
LS = the slope length-slope steepness factor;
C = the crop, cover, and management factor; and
P = the supporting erosion control practice factor (Wischmeier and Smith 1978).

To determine if a soil is highly erodible, the T-value for each map unit is substituted for A in the USLE, the combinations of land use and management factor (C and P) are not considered, and the equation is rewritten in the form $EI = RKLS/T$, where

EI = an erodibility index;
RKLS = fixed physical factors, and
T = erosion tolerance level.

A soil map unit is considered highly erodible with an $EI \geq 8$ and non-highly erodible with an $EI < 8$. The EI values were used to establish a gradient for agricultural suitability in the Missouri Flat Creek watershed.

6. Step six: watershed concepts

This step involves the development of concepts for the watershed. These concepts can be viewed as options for the future based on the suitabilities for the use(s) which give a general design or model of how problems may be solved. This design or model should be presented in such a way so that the goals will be achieved. Often more than one design or model has to be made. These concepts are based on a logical and imaginative combination of the information gathered in the former analyses. The conceptual design or model shows allocation of uses and actions. The design sets possible directions for future management of the area, and therefore should be viewed as a basis for discussion.

In the MFCWCP, the concepts were developed from a farmer meeting held in December 1987 and three small group workshops in January 1988. The purpose of the farmer meeting was to discuss the survey that had been conducted by Osterman and Hicks (1988) (step five) and examine the implications in the context of the FSA. During the meeting, the impacts of using soil erosion control practices were discussed. From the meeting, specific criteria for the plan were established, including (1) to control erosion; (2) to improve water quality; (3) to make all plans economically viable; (4) to allow farm operator autonomy; (5) to control weeds and grasses in the stream corridor, and (6) to inform, educate, and conduct research.

The three small group sessions reinforced these criteria and helped develop further concepts for the watershed. Group planning has been advocated at the national level as a means to help implement the FSA (Lewis 1988). According to one SCS official,

> The group planning process emphasizes planning with a farm producer rather than developing a plan for the producer. The more participation a landowner has in plan development and the more he or she accepts ownership of the plan, the better and more successful plan implementation will be (Holtsclaw 1988, p. 48).

The MFCWCP planning team used group planning to explain the FSA conservation provisions and their implications to the farmers. The meetings were also used to develop concepts for the watershed based on the dialogue between the farmers and the planners. The farmers brought their experience to the dialogue, while the planning team had a thorough understanding of the legal requirements for the watershed as well as of its natural processes gathered from the previous steps.

7. Step seven: watershed plan

The rather abstract concepts and concrete details are brought together in a master plan. The plan gives a strategy for development at the watershed scale. The plan is flexible, providing guidelines and options for policy-makers, land managers, and land users, about how to rehabilitate or develop an area. In such a plan, enough freedom is left to the land users to adjust their practices to new economic demands or social changes.

The overall plan in the Missouri Flat Creek project was completed in April 1988 (Osterman 1988; Osterman *et al.* 1988). The goal of the plan is to control erosion and thereby to help farmers comply with the FSA and improve water quality by reducing and eventually eliminating sediment from the creek. The planning team developed a four-part strategy for achieving this goal: (1) to plan and implement actions on a watershed basis; (2) to implement soil conservation practices through farm plans on all of the cropland in the watershed; (3) to stabilize the stream bank and channel of the Missouri Flat Creek, and (4) to supplement all actions with areawide education and implementation programs (Osterman 1988). The watershed plan encompassed resource problems and opportunities that would not necessarily be addressed in the individual plans mandated by the FSA. For example, the FSA deals only with sheet and rill erosion, the watershed plan recognized stream-bank and gully erosion, which are major sources of water quality problems.

The four strategies were undertaken through three general activities: (1) problem awareness; (2) providing awareness about the solutions, and (3) implementation of the solutions. Called objectives in the planning document, the three activities provided the heart of the planning process. The first objective was largely accomplished during the survey and meetings with the farmers (steps five and six). The problem awareness objective was also achieved through numerous individual meetings with farmers as well as coordinating agency participation in the MFCWCP. Many federal, state, and local agencies as well as Washington State University were involved.

The second objective was to provide awareness about solutions to the soil erosion problem in the watershed. Alternative cropping systems and best management practices were identified. Some of the suggested practices for the watershed include terraces, diversions, sediment ponds or basins, drop structures, stripcropping, divided slopes, permanent seeding, and grass waterways. These systems and practices will be incorporated into farm-level conservation plans. At a minimum, conservation practices will be designed to control sheet and rill erosion at tolerance, or T, levels.

The third objective, the implementation of solutions, will seek to have the conservation practices, which are prescribed in the plans, applied in the fields. Various programs will be used to encourage farmers to adopt these practices, including technical advice from the SCS, cost-sharing funding from the federal government to help pay for the practices, and the FSA Conservation Reserve Program which will pay the farmers not to plant highly erodible cropland for 10 years. In addition, if the farmers in the watershed do not follow these plans, then they will lose their eligibility for federal farm subsidy programs.

8. Step eight: education and information

In step eight, the watershed plan is explained to the affected public through education and information dissemination. This step, as well as the subsequent ones, is still being completed in the MFCWCP. In the spring of 1988, a second grant was obtained from the Department of Ecology to complete these steps. As a result, only brief summaries of the projected work are given. In the MFCWCP, the Palouse Conservation District is responsible for this effort. Much education has occurred through the previous seven steps and the second stage of the MFCWCP will build on that effort. Essentially, this step will be the realization of the second objective of the watershed plan. More information will be provided about best management practices, the implications of the FSA, and how to comply with the law. In addition, a conference on streamside management will be held. The conference will explore the myths and issues surrounding the protection of critical environmental areas, such as riparian zones, wetlands, and streamsides. The conference will seek to bring together farmers, researchers, and agency staff to explore the relationship between erosion control and stream corridor management.

9. Step nine: detailed designs

Synthesis of all the studies from various aspects and scale levels, is the most important factor of detailed designs. During the design step, the short-term benefits for the land user or individual citizen have to be combined with the long-term economic and ecological goals for the whole area. It involves the arrangement of the physical elements of the place. Detailed design is the scale of implementation. As a result, it is important to discuss the design and the suggestions with everybody who is involved in implementation and in financing.

This step in the MFCWCP will involve the preparation of individual farm-level conservation plans. Thus it will be the partial realization of the third objective of the watershed plan. The plans will include specific conservation measures that can be used so that the farmer can comply with FSA requirements. Traditionally, each plan includes an inventory of the soil and water resources on the farm. On an aerial photograph, soil types and erosion and drainage problems are outlined. From this map, a plan is developed which outlines the appropriate uses of the whole farm and conservation measures and treatments needed for protection and sustained production.

10. Step 10: plan and design implementation

In this step, the plan and designs are implemented. In the MFCWCP, this will involve the adoption of conservation practices recommended in the individual plans by the farmers of the watershed. As a result, this step represents the complete implementation of the third objective in the watershed plan. Implementation will involve specific incentives and penalties to ensure compliance with the overall goal. For instance, stream-bank erosion is a problem in the Palouse. Conservation easements along riparian areas could be used as an incentive to control stream-bank erosion. Because many of these riparian areas will need to be retired from agricultural production, payments for easements can offer farmers some financial return on the land. Another financial incentive will be cost-sharing funds from USDA to pay for conservation practices. A penalty for non-compliance will probably be the withholding of federal agricultural benefits to landowners who do not have a plan or do not follow it.

11. Step 11: administration and monitoring

In this final step, the plan is administered and monitored. In the MFCWCP, this will involve ensuring that individual farmers are following their plans, as required by the FSA. This step will be the responsibility of the Palouse Conservation District in the Washington portion of the watershed and the Latah Soil and Water Conservation District in Idaho. Both conservation districts will need to follow federal and state policies during planning administration as well as coordinate their actions with local county and city governments. Because of the complexity of the monitoring tasks and because Missouri Flat is only one small catchment area in the larger drainage basin, the hand-drawn mylar maps used for the watershed landscape analysis (step four) will not be adequate to track compliance. As a result, a computer mapping system for monitoring will probably need to be developed. This step may also result in modification to the overall plan, which may, in turn, change educational efforts, farm conservation plans, and farming practices. In addition, administration and monitoring may alter how the problem is viewed and planning goals.

12. Conclusions

The watershed approach has worked well in the Missouri Flat Creek project. The responsible administrators and planners of the SCS and Washington Department of Ecology are enthusiastic about its potential and would like to adapt it as a model to help implement FSA and clean-water goals elsewhere. The working method presented here has evolved with the MFCWCP process. The method seems especially well-suited for soil conservation planning in agricultural regions. It should be adopted and tested for other environmental issues in different settings.

A method is necessary as an organizational framework for landscape planners. As well, a relatively standard method presents the opportunity to compare and analyze case studies. John Raintree, a planner for the International Council for Research in Agroforestry in Nairobi, observed about agroforestry, 'Ultimately, as in medical science, the theory and practice of agroforestry ... must come to rest on the empirical foundation of a large body of case study results. ... there is still a paucity of published case study material' (1987, p. 242). 'Landscape planning' can be substituted for 'agroforestry' and Raintree's observation remains accurate. With future comparative case studies, landscape planning methods can be improved and landscape planners can contribute more fully to environmental problem solving.

The method suggested here reflects a middle-ground approach to landscape planning somewhere between a purely organic or a truly rational one. Mumford defined organic planning in the following way:

> Organic planning does not begin with a preconceived goal: it moves from need to need, from opportunity to opportunity, in a series of adaptations that themselves become increasingly coherent and purposeful, so that they generate a complex, final design (1961, p. 302).

In contrast, rationalists hold 'The belief that reason, independent of the senses, constitutes a superior source of knowledge' (Lai 1988, p. 19). This belief leads to a model that should be applied ***apriori*** to any situation or setting. Such a rational approach has been justly criticized as being inappropriate for use in pluralistic societies.

The method presented here is not suggested as a rigid, lock-step approach that is appropriate for every situation, but rather a flexible, iterative method that can be used when a group of people identify an issue or set of issues. The method is a framework for problem solving. As the feedback arrows in Fig. 1 indicate, there are many steps in the process where it may be adjusted or modified. Certainly, the steps may be reordered or skipped entirely depending on the situation. For instance, in some cases it may be appropriate to conduct inventories and analyses (steps three and four) before establishing goals (step two). The method represents 'a series of adaptations', in Mumford's words.

The issue or set of issues may be viewed as symptoms. The landscape planner then may make a diagnosis about the situation based on an understanding of the nature of the place in order to prescribe an appropriate intervention.

Acknowledgments

This paper is based on a plenary presentation given on March 17,1988 by one of the authors, Frederick Steiner, at the Third Annual Landscape Ecology Symposium, Observations Across Scales: Function and Management of Landscapes, sponsored by the United States Regional Association of the International Association for Landscape Ecology and held at the University of New Mexico. He appreciates the invitation from the conference organizers. Subsequently, the paper was reviewed by two anonymous referees who made several helpful suggestions. Christine Farrell typed the paper for which the authors are grateful.

The first grant application to the Washington Department of Ecology was initiated by Steiner, Ray Ledgerwood (the eastern Washington field representative of the Washington Conservation Commission), and Pat Hatley (a farmer and chair of the Palouse Conservation District). When the grant was awarded, a planning team was formed that consisted of Ledgerwood, Douglas Osterman (a land-use planner employed by the Palouse Conservation District and Steiner's former graduate student at Washington State University who helped write both grant applications to the Department of Ecology), and Theresa Hicks (a SCS conservationist). Steiner, who then moved to the University of Colorado at Denver, continued to consult with the planning team. The watershed plan itself was largely the work of Osterman. The Palouse Conservation District supervisors were active throughout the project and were essential to its success.

References

Barrett, J., Doumitt, R., Stamm, M., Tucker, C., Vassey, S. and Webb, D. 1985. Missouri Flat Creek Watershed: Ecological Inventory and Land-Use Suitability Analysis. Department of Horticulture and Landscape Architecture and Program in Environmental Science and Regional Planning, Washington State University, Pullman, WA (unpubl.)

Boardman, P. 1978. The worlds of Patrick Geddes, biologist, town planner, re-educator, peace-warrior. Routledge & Kegan Paul, London.

Dickert, T.G. and Olshansky, R.B. 1986. Evaluating erosion susceptibility for land-use planning in coastal watersheds. Coast. Zone Manage. 13(3/4): 309-333.

Dickert, T.G. and Tuttle, A.E. 1985. Cumulative impact assessment in environmental planning, a coastal watershed example. Environ. Impact Assess. Rev. 5: 37-64.

Duchhart, I., Steiner, F. and Bassman, J. 1988. Planning methods for agroforestry. Agrofor. Syst. (forthcoming).

Easter, K.W., Dixon, J.A. and Hufschmidt, M.M. (eds.). 1986. Watershed resources management. Westview Press, Boulder.

Fabos, J.G. 1979. Planning the total landscape. Westview Press, Boulder.

Fox, J. 1987. Two roles for natural scientists in the management of tropical watersheds: examples from Nepal and Indonesia. Environ. Prof. 9: 59-66.

Gans, H. 1968. People and plans. Basic Books, New York.

Hall, P. 1975. Urban and regional planning. Halsted Press/John Wiley and Sons, New York.

Holtsclaw, L. 1988. Conservation planning by hydrologic units. J. Soil Water Cons. 43(1): 47-48.

Lai, R.T.-Y. 1988. Law in urban design and planning. Van Nostrand Reinhold, New York.

Lee, L.K. 1984. Land use and soil loss: a 1982 update. J. Soil Water Cons. 39(4): 226-228.

Leopold, A. 1933. The conservation ethic. J. For. 31: 634-643.

Lewis, S.L. 1988. The changing nature of conservation planning. J. Soil Water Cons. 43(1): 40-43.

Lovejoy, D. (ed.) 1973. Land use and landscape planning. Barnes and Noble, New York.

Lowrance, R., Hendrix, P.F. and Odum, E.P. 1986. A hierarchial approach to sustainable agriculture. Am. J. Altern. Agric. 1(4): 169-173.

Marsh, W.M. 1983. Landscape planning. Addison-Wesley, Reading.

McDowell, B.D. 1986. Approaches to planning. *In* The Practice of State and Local Planning. pp. 3-22. Edited by F.S. So, I. Hand and B.D. McDowell. American Planning Association, Chicago.

McHarg, I.L. 1969. Design with nature. Doubleday/Natural History Press, Garden City, New York.

plementing the Food Security Act of 1985. Master's thesis, Program in Environmental Science and Regional Planning. Washington State University, Pullman.
Osterman, D.A. 1987b. The challenge of the Food Security Act of 1985. Palouse Conservation District, Pullman.
World, New York.
Myers, P.C. 1988. Conservation at the crossroads. J. Soil Water Cons. 43(1): 10–13.
Osterman, D.A. 1987a. Watershed planning: an approach to implementing the Food Security Act of 1985. Master's thesis, Program in Environmental Science and Regional Planning. Washington State University, Pullman.
Osterman, D.A. 1987b. The challenge of the Food Security Act of 1985. Palouse Conservation District, Pullman.
Osterman, D.A. 1988. The Missouri Flat Creek Watershed: the natural and social systems, erosion and water quality problems, farmer perception of highly erodible land, and water quality management plan. State of Washington Department of Ecology, Pullman.
Osterman, D.A. and Hicks, T.L. 1988. Highly erodible land: farmer perceptions versus actual measurements. J. Soil Water Cons. 43(2): 177–182.
Osterman, D.A., Steiner, F., Hicks, T.L. and Ledgerwood, R. 1988. Conservation planning at the watershed level. Center for Built Environment Studies, Denver.
Pimental, D., Allen, J., Beers, A., Guinand, L., Linder, R., McLaughlin, P., Meer, B., Musonda, D., Perdue, D., Poisson, S., Siebert, S., Stoner, K., Salazar, R. and Hawkins, A. 1987. World agriculture and soil erosion. BioScience 37(4): 277–283.
Raintree, J.B. 1987. The state of the art of agroforestry diagnosis and design. Agrofor. Syst. 5: 219–250.
Roberts, J.C. 1979. Principles of land use planning. *In* Planning the Uses and Management of Land. pp. 47–63. Edited by M.T. Beatty, G.W. Peterson and L.D. Swindale. Society of Agronomy, Madison.
Stalley, Marshall (ed.) 1972. Patrick Geddes: spokesman for man and the environment. Rutgers University Press, New Brunswick.
Steiner, F. 1983. Resource suitability: methods for analyses. Environ. Manage. 7(5): 401–420.
Steiner, F. 1987a. The productive and erosive Palouse environ-
Environ. Manage. 5(6): 495–505.
Steiner, F., Osterman, D.A., Hicks, T.L. and Ledgerwood, R. 1988. Landscape planning for soil conservation: a watershed approach. Paper presented at Sustainable Landscapes, Council of Educators in Landscape Architecture Annual Meeting,
Pullman.
Steiner, F. 1987b. Soil conservation policy in the United States. Environ. Manage. 11(2): 209–223.
Steiner, F. and Brooks, K. 1981. Ecological planning: a review. Environ. Manage. 5(6): 495–505.
Steiner, F., Osterman, D.A., Hicks, T.L. and Ledgerwood, R. 1988. Landscape planning for soil conservation: a watershed approach. Paper presented at Sustainable Landscapes, Council of Educators in Landscape Architecture Annual Meeting, June 22–25.
U.S. Department of Agriculture. 1978. Palouse Co-operative River Basin Study. Soil Conservation Service, Forest Service, and Economics, Statistics, and Cooperative Service, Spokane.
U.S. Department of Agriculture. 1979. Erosion in the Palouse: a summary of the Palouse River Basin Study. Soil Conservation Service, Forest Service, and Economics, Statistics, and Cooperatives Service, Spokane.
U.S. Department of Agriculture. 1986. What the conservation provisions of the 1985 farm bill mean to you (fact sheet). Soil Conservation Service, Washington
Walters, K.L. and Glancy, P.A. 1969. Reconnaissance of geology and ground-water occurrence in Whitman County, Washington. Department of Water Resources, Olympia.
Wischmeier, W. and Smith, D. 1978. Predicting rainfall erosion losses – a guide to conservation planning (Agricultural Handbook 537). U.S. Department of Agriculture, Washington.
Young, G., Steiner, F., Brooks, K. and Struckmeyer, K. 1983. Determining the regional context for landscape planning. Landsc. Plann. 10(4): 269–296.
Young, G.L. 1983. Human ecology as an interdisciplinary concept: a critical inquiry. *In* Origins of Human Ecology. pp. 355–399. Edited by G.L. Young. Hutchinson Ross Publishing Co., Stroudsburg.
Zube, Ervin H. 1980. Environmental evaluation. Brooks/Cole, Monterey.