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RECLAMATION OF ABANDONED MINE LANDS AND FISH AND WILDLIFE MITIGATION NEEDS[1]

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MASTER

Abstract.--The Surface Mining Control and Reclamation Act of 1977 has provided a funded program for reclaiming the nation's abandoned coal-mine lands. This paper reviews methods of inventorying such lands and discusses criteria and planning strategies needed to ensure that fish and wildlife values are given consideration in development and implementation of reclamation plans. Habitat evaluation methods are briefly discussed.

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DISCLAIMER

INTRODUCTION

One of the major achievments of the Surface Mining Control and Reclamation Act (SMCRA) of 1977 (P.L. 95-87, the Act; U. S. Congress 1977) was the enactment of provisions for a funded program to reclaim abandoned coal-mine lands (Title IV, P.L. 95-87), estimated to be $\approx 4.45 \times 10^5$ ha (1.1×10^6 A) in the United States (Holmberg 1978). Abandoned mine lands are defined by the Act as unreclaimed coal-mine lands that existed prior to 3 August 1977 and for which legal reclamation responsibility does not exist. The Act authorizes Federal, State, Indian, and rural lands reclamation programs. The Secretary of the Department of the Interior (DOI) is charged with administering all of the programs except the Rural Abandoned Mine Program (RAMP) which is administered by the U. S. Department of Agriculture (USDA) through the Soil Conservation Service (SCS). Both the DOI (1978) and the USDA (1978a) have published their final program rules and regulations.

Funding for the programs is derived from taxes of 35¢/ton on surface-mined coal, 15¢/ton on underground-mined coal, and 10¢/ton on lignite. Half of the money goes directly to the states or Indian-lands program and the remainder is allocated to farmers and small land owners to restore affected lands and to provide technical assistance and administration. The Act establishes the following priorities for funding (high to low): (1) protection of public health, safety, general welfare, and property from any extreme danger caused by past coal mining; (2) protection of public health, safety, and general welfare from adverse effects other than those classified as extreme danger; (3) restoration of the environment and ecosystems previously degraded; (4) research and demonstration projects for development of reclamation and environmental control strategies; (5) protection, repair, replacement, construction, or enhancement of public

facilities; and (6) development of publicly owned land adversely affected by past coal mining.

Planning for reclamation of abandoned coal lands requires knowledge of their location, extent, and site-by-site condition. Few states have inventoried their abandoned surface-mined lands, and information on the surface conditions of thousands of abandoned underground-mine sites is poorly documented or unknown. Using aerial photography combined with site inspections, Illinois, Ohio, and Tennessee have conducted rather comprehensive inventories of their abandoned surface-mined lands (Jewell and Haynes 1973, Klimstra and Terpening 1974, Haynes and Klimstra 1975a, State of Ohio 1974, Kaiser 1978, TVA and Tenn. Dept. Cons. 1975). Illinois has also completed a detailed study of its abandoned underground-mine sites (Nawrot et al. 1977a, 1977b; Nawrot and Klimstra 1977) and using small scale color-infared aerial photography, Indiana has inventoried its coal refuse sites (Wobber et al. 1975). These inventories were developed mainly to identify and describe problem areas needing major reclamation effort and were not designed to address fish and wildlife needs. Recreational potential of abandoned surface-mined lands have been evaluated in Illinois and Missouri (Roseberry 1963, Ford 1975, Haynes and Klimstra 1975a).

These referenced inventories have demonstrated the diversity of conditions associated with abandoned coal-mine lands. For example, in Illinois about 10% (7,152 ha or 17,700 A) of the surface-mined lands and about 17% (508 sites totaling 2024 ha or 5000 A) of the underground mine sites inventoried were classified as problem areas needing immediate reclamation (Haynes and Klimstra 1975a, 1975b, Nawrot et al. 1977a, 1977b). In Ohio and Tennessee approximately 49% (72,486 ha or 180,000 A) and 43% (6475 ha or 16,000 A), respectively, were identified as needing major reclamation based on such criteria as presence of hazardous mine openings, highwalls, landslide areas, barren

and toxic spoilbanks and refuse materials, toxic waters, and abandoned roads, structures, and other debris (State of Ohio 1974, TVA and Tenn. Dept. Cons. 1975). If these lands do not clearly fall under Priority 1 or 2 status, they will likely be classified as Priority 3. Mitigation of the environmental problems associated with these lands should benefit many species of fish and wildlife.

Past inventories have also shown that many abandoned lands have become revegetated through natural succession, or sometimes through planned reclamation. Many of these lands are in need of only minor, if any, additional reclamation or development. They include managed and unmanaged forests, lakes and small ponds, recreation areas, pastures and forage land, and other fish and wildlife habitats on both graded and ungraded lands. Some of these lands may fit into Priority 3, but most probably should be classified at lower funding categories. Plans for any further reclamation or development of such lands must be carefully evaluated to prevent significant negative impacts to the fish and wildlife species that currently use these lands. For example, over the past 40 years numerous research studies have reported the existing or potential value of abandoned coal-mined lands for fish and wildlife habitat (e.g., Yeager 1941, 1942; Bell 1956; Brewer 1958; Klimstra 1959; Verts 1959; Myers and Klimstra 1963; Karr 1968; Riley 1963, 1975; Haynes and Klimstra 1975a; Lyle et al. 1976; Ashby et al. 1978; Chapman et al. 1978; Kimmel and Samuel 1978; Riley and Brown 1978). Other studies have shown that one can reasonably predict the amount of time needed to reach a certain degree of ecosystem recovery if highly toxic (e.g. pH < 4.0) systems are excluded from consideration (Campbell et al. 1965, Carrel et al. 1977, DeMott 1978, Vaughan et al. 1978). For example, Vaughan et al. (1978) have shown that alkaline drainage systems in eastern Tennessee disturbed by contour surface mining could recover to original or near predisturbance levels over a period of 20 to 24 years (i.e., population size, number of

taxa, and species diversity). Recovery of fish populations were shown to occur in only those disturbed streams where migration of fish was possible from connecting undisturbed streams (i.e., refuges).

Regulatory authorities should be aware of the potential value of abandoned lands for mitigation and enhancement of fish and wildlife habitat even when this use is not the primary one. Criteria and guidelines should be developed not only to correct problem situations, but also to incorporate both existing and planned fish and wildlife habitats into future land-use and reclamation plans. One suggested approach for accomplishing this task is discussed below.

RECLAMATION OF ABANDONED MINE LANDS: PLANNING FOR FISH AND WILDLIFE

Inventory and Other Supporting Data Bases

As depicted in Figure 1, the first step in planning for the reclamation of abandoned lands is to develop a comprehensive and descriptive data base of all sites and to classify these sites into the priorities established by SMCRA. In response to this need, the Office of Surface Mining Reclamation and Enforcement (OSM) within DOI has contracted the Oak Ridge National Laboratory (ORNL) to assist them in developing a national inventory of abandoned mines and related problems. The project includes four phases: (1) Create an initial inventory and design a final inventory system with computer storage and retrieval capabilities, using existing maps, photographs, and previous inventory data bases. (2) Develop a computerized system for storage and retrieval of spatial data. (3) Select study areas for testing and demonstrating the use of remote sensing technology. (4) Complete a national inventory, which will be available for continuing analysis of problems and conditions.

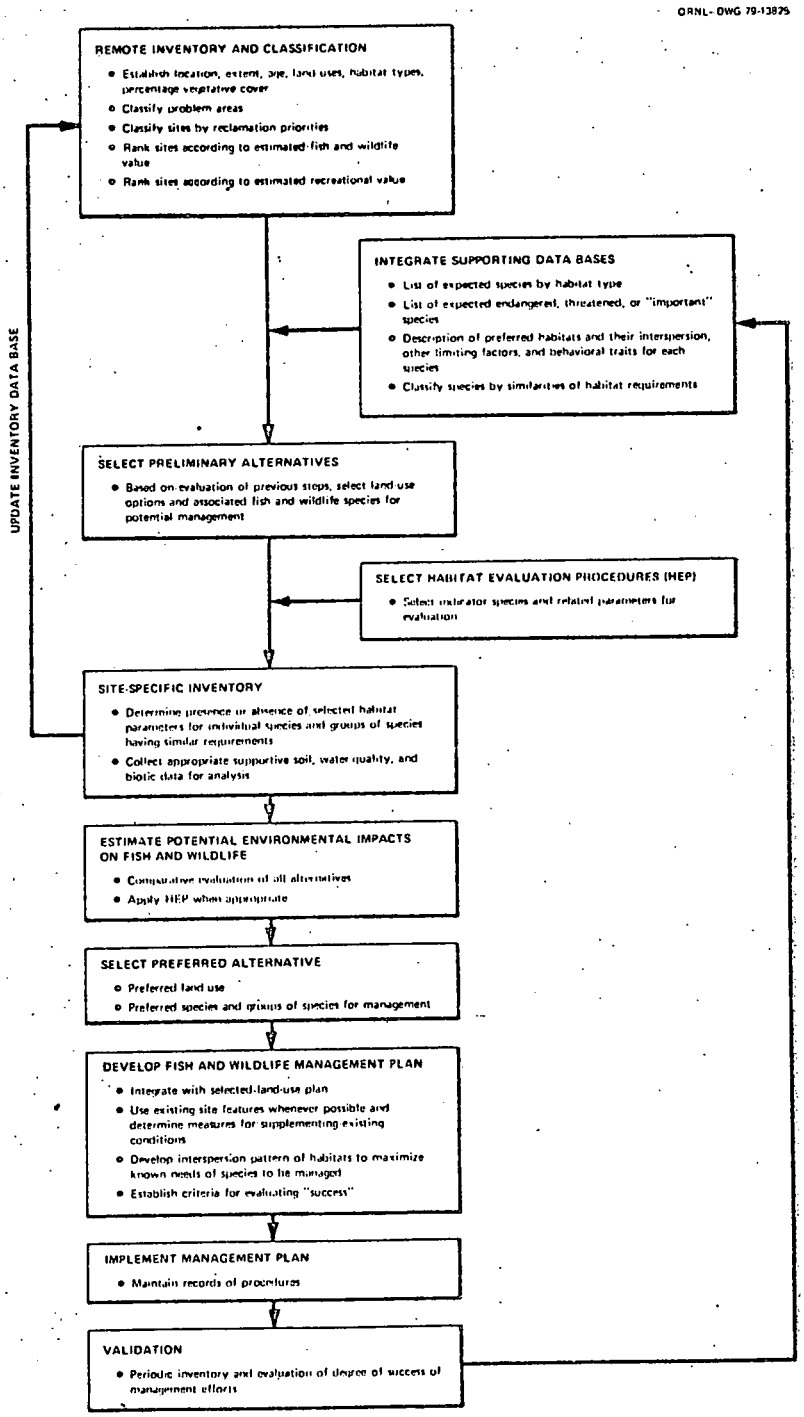

Figure 1. Procedures for integrating fish and wildlife considerations into plans for reclamation of abandoned mine lands.

Once the location of abandoned mines is established, much of the information needed by decision makers can be obtained through the use and analysis of aerial photographs and supporting data sets. Evaluation of aerial photographs can provide the extent of barren and poorly vegetated sites and existing habitat types both on and adjacent to the abandoned lands. Further evaluations can allow: (1) tentative classification of sites according to established priorities for funding; (2) ranking of sites for fish and wildlife habitat based on determination of the edges, vegetation type, distribution and cover, and surface water measured directly from aerial photographs (Lines and Perry 1978); and (3) classification of sites according to selected measures of recreational potential (Roseberry 1963, Forrey 1973, Ford 1975, Haynes and Klimstra 1975a).

Existing data sets for fish and wildlife can also be searched to obtain information about species including their behavioral traits, habitat diversity and interspersion needs, and other limiting factors that might occur on abandoned mine lands (fig. 1). To optimize use of such data, it should be computerized and made available to users along with simple user instructions. Otherwise, time consuming searches of the literature will be required to obtain the needed information.

A prime example of this type of system is FAUNA, a computerized faunal information system for use by land managers in land-use decisions affecting fish and wildlife resources (Mason et al. 1979). This work is being directed by the U. S. Fish and Wildlife Service's (USFWS) Eastern Energy and Land Use Team. FAUNA is largely textual with information on species distribution, key habitat factors, food, cover and niche requirements, and management potential for fish, amphibians, reptiles, birds, mammals, and selected aquatic and terrestrial invertebrates (Mason et al. 1979). A major goal of the USFWS is to provide users with such data for regions, ecosystems, and

specific habitat types. Progress is being made in achieving this goal but much more work remains to be completed (USFWS 1977, 1978; Patton 1978; Schweitzer et al. 1978).

Habitat evaluation procedures (HEP) presently being developed and tested by the USFWS (Schamberger and Farmer 1978), may be useful for planning the reclamation of abandoned lands (fig. 1). These procedures were designed to provide baseline information on selected indicator species (singly or in associations) and their habitat needs for subsequent use in evaluating and quantifying environmental impacts on these species from proposed projects and land-management schemes. Their use assumes that the quality of various ecological communities can be objectively characterized and quantified by determining the degree to which known life requisites of indicator species are provided. Thus, use of HEP is restricted to those species whose habitat requirements are well documented in the literature. Application of HEP leads to determination of a habitat suitability index (based on assessment of physical and biological parameters), a habitat quality index (total of the suitability indices for all indicator species), and a habitat value (product of the area of habitat and the habitat quality index) (Flood et al. 1977, Raleigh 1978, Schamberger and Farmer 1978, USFWS 1979). If HEP are to be used in evaluating abandoned mine lands, indicator species and their physical and biological limiting factors must be identified so that these factors can be sampled during subsequent site-specific inventories. The USFWS should plan to provide guidance and assistance to potential users if they intend for HEP to be used in the evaluation of reclamations for abandoned lands.

Careful evaluation of existing features of abandoned lands, as determined remotely and prior to site-specific inventories, will provide information needed by planners to tentatively select several reclamation options together with important factors needed for management of fish and wildlife.

Subsequent site-specific inventories (fig. 1) should then be designed to assess the presence or absence, quality, and quantity of these factors. Site inventories may also lead to reclassification of funding priorities based on additional information obtained, e.g., hazardous mine openings, acid mine drainage, or other conditions not previously identified by remote evaluations.

Determining Environmental Impacts on Fish and Wildlife and Selection of Preferred Reclamation Options

Site-specific inventories that are properly designed and conducted to measure the critical or limiting factors should provide the information needed by planners to evaluate impacts of proposed reclamation plans. This should lead to the selection of preferred reclamation and land-use alternatives resulting in the correction of environmental problems and optimization of fish and wildlife values (fig. 1). The HEP discussed earlier (Schamberger and Farmer 1978, USFWS 1979) can be used to quantify impacts on selected indicator species due to proposed reclamation activities. For those species or groups of species possessing similar habitat requirements which are not or cannot be evaluated by HEP, a perturbation matrix may be utilized (States et al. 1978). This type of matrix provides a qualitative assessment of potential impacts by comparing proposed reclamation activities with expected damage or destruction of habitats and their biota.

Development, Implementation, and Validation of Fish and Wildlife Management Plans

Fish and wildlife management plans should always be integrated with the final reclamation strategy and corresponding land use (fig. 1). The basic guiding philosophy should be to utilize as many of the existing features of the abandoned sites as possible, while using supplemental plantings, water sources, and other measures as needed to

enhance food, cover, water, and spatial needs for the managed species. It is also important to remember that the abandoned sites represent only one or more components of a larger management unit that includes the land uses and habitats adjacent to them.

Two other somewhat conflicting management approaches must be considered. One focuses on increasing the total number of species that can use an area by increasing habitat diversity, while the other must recognize the special needs of any endangered, threatened, rare, or otherwise important species that may be adversely affected by the intended management strategies. Therefore, planners must go a step beyond simply identifying important habitat types and incorporating them into management plans. The optimum percentage of each habitat type and the spatial design of habitats (interspersion) which provide the most benefits to single or groups of species must be considered; this should include provision of movement corridors between one habitat type and another.

Numerous helpful documents which discuss in detail the above management concepts are available to planners (e.g., Leopold 1933, Lagler 1956, Giles 1971, Burger 1973, Leedy et al. 1978, Rafaill and Vogel 1978, Raleigh 1978, Puglisi and Hassinger 1978). In addition, the expertise of experienced biologists should be employed at all stages of the project planning, review, and implementation.

We believe that it is extremely important for planners to develop methods and criteria for validating the success or deficiencies of the implemented management plans. This requires diligent descriptive record keeping of the project design and activities. It should be continued with measurement and evaluation of previously selected criteria of success at periodic intervals following implementation of plans. Plans should provide for the integration of such data into existing data sets as quickly

as possible to assist in development of future management plans (fig. 1). Also, in later years of abandoned mine lands programs, such data may be needed to justify additional funding and continuation of programs.

CONCLUSIONS

We believe that successful integration of fish and wildlife values is possible at all levels of reclamation of abandoned lands. Programs for reclaiming these lands should greatly benefit many species of fish and wildlife through the correction of adverse conditions associated with past coal mining. However, we expect that the degree of significant positive benefit to fish and wildlife through reclamation or development efforts will decrease for some proposed projects with low funding priority (i.e., SMCRA, some Priority 3 or lower priorities), and there could be significant adverse effects on fish and wildlife resulting from reclamations of such sites.

Our involvement with the Rural Abandoned Mine Program (RAMP) in Tennessee through Committee review of applications for reclamation funding has impressed upon us the diversity of opinions regarding reclamation-priority classification and proposed reclamation and management alternatives. For each proposed project reviewed by the RAMP Committee, numerous alternatives (e.g., whether or not highwalls should be eliminated or affected lands returned to their approximate original contour, sources of topsoil or other material for amending toxic conditions, species of vegetation to be established) were apparent, all of which may affect fish and wildlife populations. Such differences of opinion have lead us to believe that an environmental impact assessment (EIA) should be prepared for every proposed reclamation project, and in those cases where an EIA reveals reasonable prediction of significant negative impacts to the environment, an environmental impact statement (EIS) should

also be prepared as dictated by the National Environmental Policy Act (NEPA). Many of the recommendations and procedures presented in this paper for coordinating fish and wildlife management plans into other land-use and reclamation plans can be an important part of preparation of environmental impact documents.

Our involvement with RAMP has also shown us that this Program will use EIA's and EIS's within the framework of recent Council on Environmental Quality (CEQ) regulations and guidelines for implementing the National Environmental Policy Act (CEQ) 1979; USDA 1978a, 1978b). Although we expect the OSM to clarify further their position with regard to the CEQ regulations, their compliance policies for using EIA's and EIS's in their abandoned mine programs have not yet, to our knowledge, been clearly defined (DOI 1978). We strongly urge fish and wildlife biologists to assume an active role in these evolving programs to ensure the mitigation, enhancement, and protection of fish and wildlife in all reclamation and development efforts.

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