

INFORMATION AND EDUCATION SESSION

FUTURE LIGNITE MINING IN THE SOUTH AND IMPACTS ON FISH AND WILDLIFE UNDER SM CRA^{ab}

RONNIE J. HAYNES, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN 37830

Abstract: Large deposits of recoverable lignite (> 16 billion tons) occur in parts of Alabama, Arkansas, Louisiana, Mississippi, and Texas. Commercial surface mining of these reserves has occurred only in eastern Texas, but additional mining has been proposed for Texas and the other states during the 1980's. Almost all of the new mining would occur in the Southeastern Mixed Forest (Pineywoods) ecoregion, and the Prairie Parkland ecoregion of eastern Texas. Potential impacts on fish and wildlife will be lessened because of the enactment of the Surface Mining Control and Reclamation Act of 1977 (P.L. 95-87) and the permanent program regulations. However, major impacts on fish and wildlife may still occur as a result of habitat destruction and inadequate reclamation strategies. The prevention of significant impacts will depend mostly upon the diligent implementation and enforcement of the requirements of the Act, including evaluation of fish and wildlife impacts by trained and competent biologists. These issues and research and assessment needs are discussed.

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Reserves of lignite in the South (Fig. 1) that are recoverable by surface mining exceed 16 billion tons and typically occur in seams ranging from about 1 to 4 m and at depths of 4 m or less (Mining Informational Services 1978). Most of these reserves are located in the Southeastern Mixed Forest (Pineywoods) ecoregion with lesser amounts in the Prairie Parkland, Prairie Brushland, and Southern Floodplain ecoregions (Fig. 1).

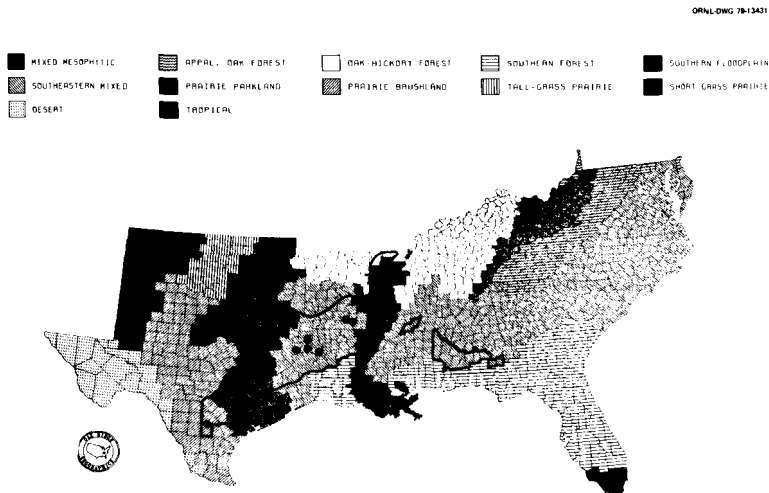


Fig. 1. County ecoregion classification (after Bailey 1978) overlain with approximate location of recoverable lignite reserves (outlined) in the South and proposed new mine openings or expansions (●).

^aSurface Mining Control and Reclamation Act of 1977 (P.L. 95-87).

^bPublication No. 1372, Environmental Sciences Division, ORNL.

Estimates of recoverable reserves are conservative as exploration is not complete and discovery of additional reserves is likely.

As of 1978, commercial lignite mining in the South had occurred only in east Texas (Mining Informational Services 1978, The Ozarks Regional Commission 1978). Plans for future mining have been announced publicly for most of the states with recoverable reserves (Fig. 1, Table 1); all of these mines would be surface mines. These estimates of future mining are limited in that they reference only projects that have been publicly announced. Other operations may be proposed in the near future and some proposed projects may never occur due to various economic constraints.

Table 1. Proposed lignite surface mines in the south.

<i>Location</i>	<i>Start-up year and planned production capacity (million tons/yr)</i>	<i>References</i>
<i>Alabama</i>	No industry announcements available, but some mining expected before 1985.	
<i>Arkansas</i>		
Two mines; Hampton and Warren Counties	1986, 1988 (9)	Stone and Webster Engineering Corp. et al. 1978
<i>Louisiana</i>		
One or more mines in DeSoto County	Beginning in 1984 (4.8)	The Energy Daily 1978
<i>Mississippi</i>	No information available	
<i>Texas</i>		
Freestone County	Prior to 1977-Expansion of existing mine (5.4)	White and Clemons 1977
Grimes and Brazos Counties	1981 (6)	White and Clemons 1977 U.S. Bureau of Mines 1978
Harrison County (two mines)	Prior to 1977-Expansion of existing mine (0.3); 1984 (3)	White and Clemons 1977
Henderson County	1981 (4)	U.S. Bureau of Mines 1978
Limestone County	After 1985 (7)	White and Clemons 1977
McMullen and Atacosta Counties	1979 (5)	White and Clemons 1977 U.S. Bureau of Mines 1978
Milam County	Prior to 1977-Expansion of existing mine (4.8)	White and Clemons 1977
Panola County	1976-Expansion of existing mine (16)	U.S. Bureau of Mines 1978
Robertson County	1983 (8)	White and Clemons 1977 U.S. Bureau of Mines 1978
Rusk County	After 1985 (7)	White and Clemons 1977
Titus County	1974-Expansion of existing mine (10)	White and Clemons 1977 U.S. Bureau of Mines 1978

Surface mining for lignite in the South will disturb large acreages, thereby affecting populations of fish and wildlife. The enactment of the Surface Mining Control and Reclamation Act of 1977 (SMCRA, P.L. 95-87) and permanent program regulations have provided a minimum set of environmental protection and mitigation standards that will lessen impacts on fish and wildlife (U.S. Congress 1977, U.S. Department of the Interior 1979a). However, major impacts on fish and wildlife due to future lignite mining are possible. The degree of impact appears to be dependent mostly on the diligent implementation and enforcement of SMCRA and related laws (e.g., Endangered Species Act of 1973, as amended; Fish and Wildlife Coordination Act, as amended) and on the extent and type of loss of habitats for fish and wildlife.

POTENTIAL IMPACTS ON FISH AND WILDLIFE

Major, long-term impacts on fish and wildlife due to future lignite mining in the South are attributable to damage or destruction of habitats. Other impacts may result because of noise, traffic, obstructions (e.g., fences, ditches, and transmission lines), and other types of direct or indirect human disturbance. However, these impacts are minor and of short term with regard to population effects, if suitable habitats remain available within the affected area. Although the disturbed lands must be reclaimed, long-term impacts on the fish and wildlife are to be expected when postmining reclamations result in major changes in land use and diversity and interspersions of habitat types and in cases where reclamation technology cannot achieve restoration of certain naturally occurring habitat types.

Due to the large overburden to lignite ratios and large volumes of solid waste associated with lignite reserves in the South, extensive areas of land would be disturbed by future lignite mining over the typical 30-yr life span of a mining operation. Between 162 to 324 ha per mine will be disturbed each year (Harner et al. 1978, Stone and Webster Engineering Corp, et al. 1978). Thus, only for those proposed mine openings or expansions listed in Table 1 (15 mines), between 72,900 and 145,700 ha disturbed over an expected 30-yr operating time. The magnitude and importance of impacts on fish and wildlife due to such land disturbance, as well as any additional disturbance resulting from future lignite mining not yet publicly announced, is difficult to quantify. It will depend upon: (1) the types of habitat affected and their respective carrying capacities; (2) the commonness or rareness of habitat types and associated wildlife; and (3) the degree of protection, reclamation, and restoration of specific habitat types and their associated biota.

A rudimentary appreciation of the loss of habitat important to several groups of animals that might be affected by a typical lignite mine in Texas is presented in Table 2. operation of the 15 proposed mines listed in Table 1 for one year could result in the loss of 60,000 to 120,000 small mammals, 375 to 750 white-tailed deer, 21,000 to 42,000 songbirds, 1,200 to 2,400 game birds, 15 to 30 large predators, and 18,000 to 48,000 reptiles and amphibians. Obviously, these estimates might be more or less for other regions and specific habitat types within regions. Whether or not hypothetical losses of this magnitude would be significant must be determined through evaluation of site-specific mining and reclamation plans by competent biologists in order to predict impact on the survival and reproduction of all species that would be affected.

Table 2. Potential impacts of a lignite mine in Texas on several types of animals based on general estimates of animal carrying capacity and land disturbance.

<i>Type of animal</i>	<i>Estimated carrying capacity^a</i>	<i>Estimated animal loss per mine per year^b</i>
Small mammals	24/ha	4,000-8,000
White-tailed deer	1/6.5 ha	25-50
Songbirds	9/ha	1,400-2,800
Game birds	1/2 ha	80-160
Large predator	1/200 ha	1-2
Reptiles/amphibians	8-10/ha	1,200-3,200
Fish/reservoir	140-168 kg/ha	-

^aBased on type of animal (Texas region) from U.S. Bureau of Land Management (1979).

^bBased on a land-disturbance factor of 162 to 324 ha (400-800 acres) per mine per year (Harner et al. 1978, Stone and Webster Engineering Corp. et al. 1978).

Damage or destruction of habitat by future lignite mining is also important with regard to the presence or absence of federally endangered and threatened species (U.S. Department of the Interior 1979b, 1975), or other important species that may or may be protected by various state legislation. The number of federally protected species that may occur in different ecoregions of the South (Bailey 1978) and within areas of recover-

able lignite reserves is presented in Fig. 2. The southern Alabama lignite area (Southeastern Mixed Forest ecoregion) exhibits a high potential for conflict. This type of regional scoping of potential conflict between lignite mining and the known distribution of protected species provides a rough idea of future problems. However, much more detailed analysis of local habitat types is necessary to assess potential impacts adequately. Once it has been established that protected or important species may occur on a proposed mining site based on evaluation of habitat requirements and known distributions of such species, an intensive search or hunt of habitats is needed to assess impacts properly. Searches should apply knowledge of behavioral traits of potentially occurring species and should be conducted during an appropriate time of the day or season. Commonly used sampling methods such as road counts and transect observations are of little or no use in finding rare species, because of the very low probability of species encounter.

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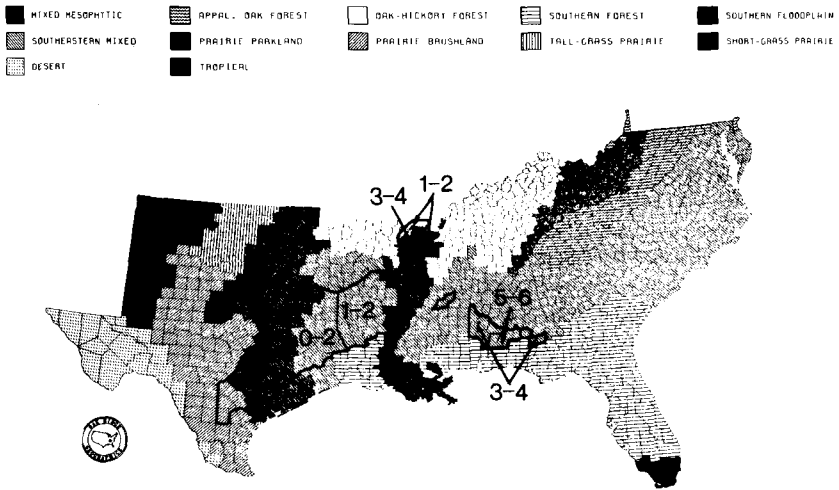


Fig. 2. Number of federally protected species (Shreeve et al. 1978) that may occur within ecoregions (after Bailey 1978) and areas of strippable lignite reserves (outlined) in the South.

If there is an reason to believe that proposed mining would affect any federally protected species, the state regulatory authority should request through the Office of Surface Mining Reclamation and Enforcement (OSM) a consultation and review by the U.S. Fish and Wildlife Service. If OSM is the regulatory authority (e.g., on federal lands, in states not having an approved regulatory program), a formal consultation and review by the U.S. Fish and Wildlife Service is required in cases where proposed mining may result in impacts upon federally protected species (U.S. Department of the Interior 1978a).

For protection of fish and wildlife it is very important to determine the commonness of rareness of specific habitat types. Although commonness and rareness are not defined quantitatively, uncommon or rare habitat types can generally be identified within larger and more common types. For example, rare habitat might be one which includes the presence of a free-flowing stream or river, riparian areas and bottomland forest, patches of upland woodland; or strips of vegetation along fencerows and rights-of-ways located in extensively farmed or pastured areas; or, small patches of open areas within or adjacent to large forested tracts. Such areas increase diversity of biota and serve as

important refuges and corridors of movement from one habitat type to another (Cloud 1978, Haynes 1978, Van Waggoner 1978, Klimstra et al. 1977, Siderits and Radtke 1977, Hardin et al. 1976, Vance 1976). Where habitat types are common within a given geographical realm, small losses of such habitat may or may not reduce total carrying capacity, and likely would not affect survival of any associated wildlife species. However, there must be a point where removal of additional habitat would significantly affect population survival. Such is the case with many endangered and threatened species (U.S. Department of the Interior 1973).

The degree and type of environmental protection and reclamation requirements for planned lignite-mining operations are also important in predicting impacts on fish and wildlife. For example, soil erosion and stream sedimentation resulting from surface mining can be controlled by implementing stringent protection measures such as sediment ponds and timely revegetation of disturbed sites (U.S. Department of the Interior 1979a). However, some erosion and sedimentation will still occur, especially during the period of time immediately after mining and prior to establishment of vegetation on the disturbed area. Since surface mining has never occurred in much of the southern lignite area (Fig. 1), significant impacts to stream systems may occur, even with implementation of stringent erosion and sedimentation control measures. The presence or absence of undisturbed streams that feed into streams disturbed by mining is another important consideration. Undisturbed stream systems can serve as a refuge, thereby speeding the rate of recovery as compared with disturbed streams where such refuges do not occur (Vaughan et al. 1978). Reclamation strategies that promote postmining land uses such as industry, urban development, and cropland at the expense of fish and wildlife habitats and their diversity and interspersed would decrease species diversity and abundance of many species, while benefiting those species that are adapted to less diversity of habitat (Burger 1977, Leopold 1933).

With regard to future surface mining of lignite and other minerals, the concept that some sites may not be reclaimable is worthy of additional research and evaluation. There are ample data that demonstrate reclamation and successional trends for some ecosystems such as pasture and rangeland, pine forests, and abandoned mine lands (e.g., Ashby et al. 1978, Rafaill and Vogel 1978, U.S. Department of the Interior 1978b, U.S. Soil Conservation Service 1978, Riley 1975, Leftwich 1974, Byrnes and Miller 1973, Limstrom 1960, Grandt and Lang 1958, Brewer and Triner 1956). However, the resilience, or ability of a natural ecosystem to restore its structure following disturbance (Westman 1978) of some natural ecosystems such as wetlands, swamps, and bottomland and upland forests has not been demonstrated. For these, and probably other types of natural ecosystems, there are no long-term data that demonstrate recovery of species diversity, biomass, net primary production, nutrient balance, etc. to premining conditions. Furthermore, data are not sufficient for reasonable prediction of how long it may take to reach successional seral stages or for identifying the critical rate-limiting factors in the succession of such natural ecosystems. Regulatory authorities should be aware of the potential irreversible and irretrievable loss of ecosystems that cannot be restored, and should proceed to establish a predetermined number of long-term ecological study areas and demonstration sites. Large-scale mining in potentially low or non-resilient ecosystems should be precluded until restoration can be demonstrated or predicted with an acceptable degree of confidence through research and reclamation experience gained from established study areas.

PROTECTION OF FISH AND WILDLIFE UNDER P.L. 95-87

Requirements for protection and mitigation of fish and wildlife values are referenced in Table 3. Numerous other regulations that directly or indirectly affect fish and wildlife occur in other parts of the permanent regulatory program (U.S. Department of the Interior 1979a). Whether or not these regulations will be effective in providing adequate protection for fish and wildlife depends upon their timely implementation and enforcement as well as the expertise of competent personnel charged with evaluation of mitigation strategies and mining and reclamation plans.

Table 3. Requirements for protection of fish and wildlife values on areas proposed for surface and underground mining of coal (Source: U.S. Department of the Interior 1979a).

<i>Topical description</i>	<i>Section references</i>
Federal program for a state	736
• Requirements for implementing Endangered Species Act of 1973, as amended; Fish and Wildlife Coordination Act, as amended	736.22 (2)
Areas unsuitable for mining	Subchapter F
• Definition of areas where mining is prohibited or limited	761.11
• Protection of valuable habitats for fish and wildlife, including critical habitats for protected species	762.5
Permit application requirements	779, 780, 783, 784
• Criteria for study of fish and wildlife and their habitats; consultation with appropriate agencies	779.20, 783.20
• Criteria for fish and wildlife management and mitigation plans	780.16, 784.21
Performance standards	816, 817
• Specific standards for protection and mitigation of fish, wildlife and related environmental values	816.97, 817.97 and other related Sections

The OSM within the U.S. Department of the Interior was created to implement and enforce the provisions of the Act. On non-federal lands, OSM will delegate primary jurisdiction to states having approved programs, with oversight by OSM. With some major exceptions, states are to have their regulatory programs approved by OSM no later than 3 June 1980.

The content requirements for submission of proposed state regulatory programs for approval by OSM (U.S. Department of the Interior 1979a, Part 731.14) emphasize the importance of securing and maintaining sufficient staff to carry out the functions of the state regulatory authority. In summary, these staffing requirements include:

- (1) A description of the proposed program staff, showing job functions, titles, required job experience, and training;
- (2) A discussion of how the proposed staffing will be adequate to carry out specific functions;
- (3) An explanation of the projected use of professional and technical personnel available from other agencies, including descriptive data for such personnel; and
- (4) A description of the proposed system of coordination between all agencies having duties defined in the program.

Thus, it is extremely important that states improve the quantity and quality of their staffing not only to ensure compliance with OSM requirements but also to be well prepared to provide a comprehensive review and evaluation of permit applications for proposed mining operations. Although not legally required, perhaps the implementation of a formal certification program similar to those of the American Fisheries Society (1978) and the Wildlife Society (1978), which defines professional ethics and qualifications for certification, would be desirable.

Opportunity for public participation in the review of mining permit applications is an important democratic concept required by P.L. 95-87 (Fig. 3). The evaluatory responsibilities of the regulatory authority (federal) or state for protection of fish and wildlife

and other environmental values are great and should be scrutinized. A concerned public should accept the opportunity and responsibility to review and comment on the mining and reclamation plans, and should challenge any statements and proposed decisions which they believe to be detrimental to environmental values. Regardless of whether or not the regulatory authority accepts any or all public comments, they must respond publicly to each comment justifying their decisions. Thus, public participation in the review process can be a powerful mechanism for achieving balance in the decision-making process.

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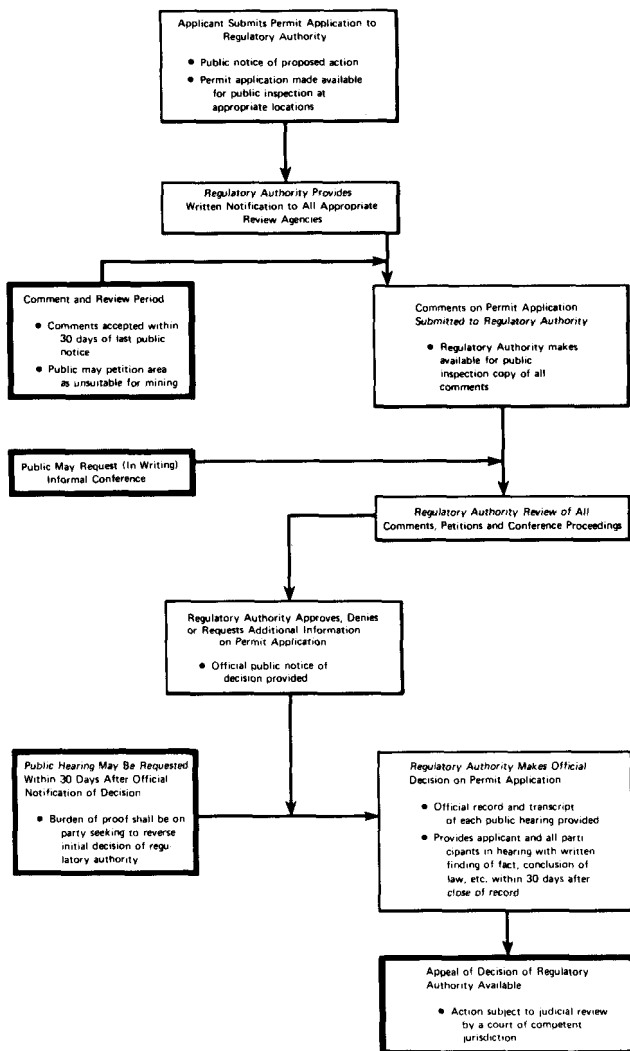


Fig. 3. Summary of opportunities for public participation (outlined) in review of mining permit applications. (Source: U.S. Dept. Interior 1979a, Part 786).

Additional protection of fish and wildlife is provided by P.L. 95-87 through establishment of procedures, guidelines, and criteria for the designation of coal-reserve areas as unsuitable for all or certain types of mining (U.S. Department of the Interior 1979a, Subchapter F). Each state regulatory authority must develop a data base and inventory system and a petition process for designation purposes, and the information must be made available to the public for inspection free of charge and for copying at a reasonable fee.

Areas important to fish and wildlife where mining has been specifically prohibited or limited by Congress include: (1) lands within the National Park System, National Wildlife Refuge System, National Wilderness Preservation System, Wild and Scenic Rivers System, and National Recreation Areas; (2) National forest lands; and (3) public parks (there are some exceptions to all of the above restrictions). Also, other lands may be designated as unsuitable based upon rather subjective criteria of significance regarding the damage or destruction of unique, uncommon, sensitive, or otherwise valuable habitats for fish and wildlife. These include (but are not restricted to) critical habitats for endangered and threatened biota, areas of high environmental quality, and buffer zones adjacent to areas precluded from mining.

Interpretation of the word "significant" for the purpose of designation of lands as unsuitable for mining is dependent upon site-specific evaluation of data by the regulatory authority. The Council on Environmental Quality (1979) in its *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (NEPA) has defined significance in terms of context and intensity of impact. Context means that significance must be analyzed with regard to society as a whole, the affected region, the affected interests, and the site-specific locality, and will include consideration of both short- and long-term effects. Intensity refers to the severity of impact based on decisions from all agencies involved in the decision-making process. In part, severity of impact must be determined by an evaluation of the special characteristics of the area to be affected, the degree to which potential impacts are highly uncertain or involve unique or unknown risks, the degree to which an action may establish a precedent for future action, the cumulative effects of a proposed action, and the degree to which an action may adversely affect an endangered or threatened species or its critical habitat (Council on Environmental Quality 1979, Sect. 1508.27).

Establishment of the concept of designation of areas as unsuitable for all or certain types of surface coal mining has provided the public with a potentially powerful mechanism for preventing or delaying mining in areas where significant environmental impacts are anticipated. Any person having an interest that is or may be adversely affected has the right to petition the regulatory authority to have an area designated as unsuitable for surface coal mining operations, and the regulatory authority must evaluate and respond to the petition according to regulatory procedures (U.S. Department of the Interior 1979a, Parts 764, 769).

IMPORTANT DATA AND ASSESSMENT NEEDS FOR PROTECTION OF FISH AND WILDLIFE

Those charged with the protection of fish and wildlife need current environmental information to predict impacts. Use of computerized data sets can greatly facilitate decision-makers in their analyses of impacts and preparation of environmental impact documents. A number of environmental data bases, some with computer-graphical capabilities, already exist and are periodically updated; others are being developed [e.g., a national fish and wildlife assessment (Schweitzer and Cushwa 1978); a system for storage and retrieval of wildlife habitat information (Patton 1978); an information system for animal species in the southeastern U.S. (Kitchings et al. 1976); a national wetlands inventory (Montanari and Townsend 1977); a forest management impact evaluation system (Thor et al. 1978); the International Biological Program (IBP) data bases (Hinckley and Haug 1977); a user-prompted graphic data evaluation (UPGRADE) system (Council on Environmental Quality 1977); U.S. Geological Survey data bases (Clarke et al. 1978); and an ecosystem data resources system (Oak Ridge National Laboratory 1978)]. In order to maximize use of these and other existing data sets in complying with P.L. 95-87 and other environmental laws, a much more efficient system of user access and transfer of information is needed. Currently, there is not enough cooperation between the developers of these data systems and their potential users. Potential users must become well-informed of the existence of such data sets and be familiar with procedures for their use.

To accommodate the requirements of P.L. 95-87, existing data bases can be modified as necessary. In some cases, new data systems will need to be developed. For example, permanent regulations for surface mining require the development of a data base and inventory system to assist in the designation of lands as unsuitable for surface mining (U.S. Department of the Interior 1979a, Subchapter F); such a data system remains to be developed. Use of a computer-graphics system that overlays mineral resources with environmental data such as known distributions and habitat requirements for endangered, threatened, and important species; wetlands; national forest; etc. will greatly assist decision-makers in identifying such lands.

The feasibility of establishing a national distribution center and a number of regional distribution centers for all environmental data bases deserves serious consideration. The 6 national laboratories (Argonne National Laboratory, Brookhaven National Laboratory, Los Alamos Scientific Laboratory, Lawrence Berkeley Laboratory, Oak Ridge National Laboratory, and Pacific Northwest Laboratory), and probably other large research centers, could be developed to serve as regional clearinghouses for environmental data systems since they already have modern computer capabilities, many existing computerized data sets, and in-house information transfer programs. For example, the Oak Ridge National Laboratory (ORNL) has computerized a large geocology data base that contains over 700 environmental variables stored in a common format for county-sub-county units, with comprehensive coverage for 16 southeastern states (Oak Ridge National Laboratory 1978). Also, ORNL, in cooperation with other national laboratories, has recently prepared a comprehensive environmental data book which presents data relating to energy, environmental, socioeconomic, and institutional characteristics of the southern United States (Copenhagen et al. 1978).

State regulatory authorities should expedite the staffing of their environmental impact analysis programs in preparation for review of mining permit applications, and possibly for preparation of environmental impact assessments and statements according to the Council on Environmental Quality (1979) regulations and guidelines (effective date of 30 July 1979) for implementing procedural provisions of NEPA. State environmental impact analysis programs should identify potential conflicts between recoverable mineral reserves and environmental resources such as fish and wildlife. Using such information, priorities for preparation of environmental impact assessments and statements should be established, and a system of ecological study areas should be developed for long-term research and data evaluation.

Major research efforts for fish and wildlife should concentrate on development and testing of new mining and reclamation strategies which are designed to optimize diversity and interspersion of habitat types in relation to postmining reclamation plans. Long-term research projects are needed to establish baseline conditions prior to mining and to document the recovery of affected ecosystems after mining. It is important to determine if natural ecosystems affected by surface mining can recover within an acceptable period of time, and to identify the critical factors that limit recovery. Also, more research is needed for evaluation of the concept of preserving refuges or islands within or adjacent to areas to be mined to ensure and speed the recovery of affected ecosystems (Miller 1978, Vaughan et al. 1978).

Enactment of P.L. 95-87 has created a challenge to regulatory authorities to protect, preserve, mitigate, and sometimes enhance fish and wildlife and other environmental values located on coal-reserve lands. Hopefully, this challenge will be met and won by dedicated and well-trained fish and wildlife biologists, thereby allowing for planned and acceptable recovery of most of our recoverable coal reserves.

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