ACTION PLAN FOR PROTECTING ALBANIA'S NATURAL RESOURCES

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Terra Institute, Ltd., has provided technical assistance in Albania since 1994. Under both the Land Legislation and Policy Project (LLPP) and the Land Markets in Albania Project (LMAP), the Institute has archived almost 50 reports, papers, draft legislation, and commentaries on land legislation, land registration, land tenure, and other land market-related activities in Albania.

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All views, interpretations, recommendations, and conclusions expressed in this paper are those of the author and not necessarily those of the supporting or cooperating institutions.

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GLOSSARY

BMP	Best Management Practice
CEP	Council of Environmental Protection
EAP	Environmental Awareness Program
EC/PHARE	European Community
EIA	Environmental Impact Assessment
FPRI	Forest and Pasture Research Institute
GIS	Geographic Information System
HI	Hydrometeorology Institute
IFDC	International Fertilizer Development Center
IPRS	Immovable Property Registration System
LIS	Land Information System
LPAP	Land Protection Action Plan
LRI	Land Research Institute
MOAF	Ministry of Agriculture and Food
PMU	Project Management Unit
SARA	Study for the Agricultural Reorganization of Albania
UNEP	United Nations Environmental Programme
UPI	Urban Planning Institute
WG	Working Group
WWI	Institute for the Study and Design of Waterworks

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by

James G. Bockheim*

1. INTRODUCTION

In January 1995, the Project Management Unit (PMU) of the Immovable Property Registration System (IPRS) sought to determine the magnitude of soil erosion on agricultural land in Albania, to develop a land protection policy, and to assist in drafting laws to protect the country's land base. It became apparent, however, that soil erosion was only one of many manifestations of land degradation and that there was need to develop a comprehensive plan to preserve all natural resources of the country (see Annex 1). At this date, two reports had identified the types and geographic locations of environmental degradation and outlined the components of an environmental action plan: "Albania Environmental Strategy Study: Major Environmental and Natural Resource Management Problems" (1993, World Bank, Washington, D.C.), and "Report on the Environmental Situation in Albania: National Environmental Action Plan" (1993, Ministry of Health and Environmental Protection, Tiranë).

At present, the Massey report (1995, Dean Massey, "Legal and Institutional Framework for Land Protection in Albania," Terra Institute, Mt. Horeb, Wisc.) has reviewed existing Albanian laws on various types of land degradation, discussed the legal framework developed in other countries to encourage sustainable land use, and proposed a Land Protection Action Plan (LPAP) for Albania. The plan put forward recommended that a Working Group (WG) composed of specialists from several agencies be established under the coordination of the Land Policy Department of the IPRS-PMU. The plan also recommended that advisory personnel from additional agencies be invited to participate in the activities of the WG. Six steps were identified under the action plan, including detailed documentation of the environmental problems, identification of high-risk areas, development of educational programs, preparation of needed legislation, development of an economic incentive program for land users, and establishment of a Land Information System (LIS) for monitoring changes in land use. The Massey report recommended that a timetable be established for each step.

In March 1995, with the assistance of expert advisors, Albert Dubali, head of the Land Policy Department of the IPRS-PMU and of the WG, began to establish procedures for preparing and implementing the LPAP. He was also assisted with the design of information-gathering activities by the WG and supporting agencies. Finally, he asked for suggestions on the generation of a public awareness program on land protection.

2. FORMULATION AND FIRST MEETING OF LPAP WORKING GROUP

Dubali invited representatives from the following agencies to attend the first meeting of the WG: Land Research Institute (LRI), Forest and Pasture Research Institute (FPRI), Hydrometeorology Institute (HI), Institute for the Study and Design of Waterworks (WWI), and Urban Planning Institute (UPI). Representatives of each of these organizations (except UPI) came to the opening meeting on 13 March 1995, the minutes of which are provided in Annex 2.

With Dubali's leadership, the WG agreed to compile the following information for its next meeting: (1) documentation of environmental problems under the jurisdiction of the respective agencies (i.e., data and maps), (2) identification of high-risk areas, and (3) suggestions of needed legislation. Representatives generally agreed upon

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the types and severity of land degradation at the second meeting of the WG on 20 March 1995, and expressed enthusiasm about working together on a multi-agency endeavor.

The following recommendations were made to ensure that the LPAP Working Group functioned effectively: that minutes be taken at each meeting and distributed prior to the next meeting; that the Urban Planning Institute be represented on the WG since many land degradation problems (such as loss of prime farmland and soil and water contamination) pertain to urbanization; that representatives from the Institute of Hygiene and the Ministry of Education be added for expertise in environmental protection and for aptitude with an environmental awareness program, respectively; and that an agency such as the Hydrometeorology Institute be chosen for groundwater protection. The Committee of Environmental Protection of the Ministry of Health, finally, was to coordinate the activities of LPAP.

3. DETAILED DOCUMENTATION OF LAND DEGRADATION PROBLEMS

The LPAP Working Group confirmed the major types of land degradation needing immediate attention in Albania: (1) excessive soil erosion; (2) deforestation; (3) flooding of former reclaimed land; (4) landslides; (5) salinization; (6) contamination of surface and groundwater from agrochemicals; (7) contamination of soils, water, and air from industrial pollution; (8) uncontrolled municipal waste disposal; (9) urbanization on high-quality agricultural land; and (10) flooding and turbidity from the mining of gravel in riverbeds and riverbanks. Observations of these types of land degradation are given in Annex 3.

Soil erosion was accepted as the key problem relating not only to environmental quality but also to Albania's food security. In addition, there was great potential for catastrophic flooding from widespread deforestation, loss of soil through erosion, and sedimentation that reduced the storage capacity in reservoirs; the lower coastal plain was especially susceptible to flooding because many of its earthen dikes had been weakened through neglect. Air pollution had created an environment conducive to respiratory diseases, water pollution, and infant deaths (1993, Ministry of Health and Education, Tiranë); summary data indicated that the contamination of soil, water, and air pollution had directly affected the health and welfare of the people of Albania

3.1 IDENTIFICATION OF AREAS OF HIGH RISK TO ENVIRONMENTAL DEGRADATION

The Ministry of Health and Environmental Protection (1993, Tiranë) had prepared a sketch map depicting the "hot spots" of land degradation along with a table showing the severity of each by district. The most important hot spots to be addressed were Elbasan, Vlorë, Fier, Ballsh, Kukës, Rubik, Laç, and Tiranë. Although a World Bank-supported study had identified areas of severe erosion on a 1:200,000 scale map, more detailed 1:50,000 scale maps of soil erosion and other forms of land degradation were needed by district and still smaller scale maps were essential for showing the high-risk areas. For each district, the International Fertilizer Development Center (IFDC) had prepared digitized soil maps that could be used as baselines. In each prefecture, the Committee on Environmental Protection (CEP) had placed environmental inspectors who could provide data and expertise for refining delineation of high-risk areas.

3.2 NEEDED RESEARCH ON ENVIRONMENTAL DEGRADATION

Based on preliminary deliberations of the LPAP Working Group and interviews with directors and specialists of various institutes (a list of contacts is given in Annex 4), there was need for more research on protecting Albania's natural resources. Air, soil, and water quality could be monitored on a routine basis. Air pollution was generally restricted to such industrialized urban areas as Kukës, Rubik, Laç, Elbasan, Tiranë, and Vlorë. Air monitoring could detect gases, such as sulfur dioxide, sulfuric acid mist, carbon monoxide, ammonia, and nitrogen oxide, hydrocarbons, and particulates (dust, soot, and ash) that affected human health. A limited amount of this type of research was being done by the Institute of Hygiene and the Faculty of Natural Sciences at the University of Tiranë.

There was no comprehensive program for monitoring water quality, including surface water (reservoirs, lakes, rivers, and irrigation channels) and groundwater. The Hydrometeorology Institute was checking water quality, including biological oxygen demand, heavy metals, and suspended solids, for six major rivers at their points of discharge into the Adriatic Sea. Surface water and groundwater pollution was produced from industrial discharges, particularly of mining industries, use of agrochemicals, especially during the previous collective government, and lack of on-site small-scale wastewater disposal. Surface water quality was impacted by the mining of river basins and the disposal of municipal solid waste directly into rivers and the Adriatic Sea. Monitoring of surface-water quality could be done at Durrës (agrochemicals), Rreshen and Tiranë (industrial and domestic discharge), and Fier

and Vlorë (industrial and mining discharge). Virtually no studies had been done of groundwater quality. Groundwater monitoring studies, done cooperatively by the Hydrometeorology Institute and the Land Research Institute, could be initiated at Fier, Tiranë, and Vlorë.

Soils had been contaminated by indiscriminate application of agrochemicals (pesticides) and poor irrigation practices, which led to a buildup in salts (salinization) during the collective regime. Moreover, heavy metals from industrial pollution had accumulated in the soils. Soil monitoring could be done in Vlorë District for salts, in Durrës District for pesticides, and in Fier, Tiranë, and Vlorë districts for heavy metals.

An effective way to integrate these and other studies would be to examine the fluxes of water, particulates, and dissolved chemicals in a watershed that included multiple-use activities. For example, the Drini watershed featured pristine conditions in its mountainous headwater zone (a control area). However, deforestation and overgrazing in the hilly zone of this watershed had led to excessive soil erosion; industrial pollution due to mining had taken place near Kukës; and agrochemical pollution due to intensive agriculture had occurred in the coastal plain near Lezhë. A study of this watershed would demonstrate to the Albanian public the dangers of land degradation and to Albanian scientists the importance of a multidisciplinary approach to the solution of regional and national environmental problems.

Applied research on environmental degradation was needed to improve the productivity of agro-ecosystems in Albania. These studies included: (1) irrigation system alternatives to the gravity system, (2) ways to maintain drainage channels in reclaimed areas of the coastal plain, and (3) farming system approaches to avoiding soil erosion.

3.3 EDUCATIONAL PROGRAMS

There were two components to an educational program dealing with land protection. The first part consisted of educating Albania's 500,000 new farmers in land protection, especially in minimizing deforestation and soil erosion, maintaining drainage and irrigation channels, and avoiding contamination of surface and groundwater with agrochemicals and soluble salts, as well as educating its urban dwellers on issues such as loss of prime farmland and proper waste disposal. The second component of the educational program involved establishing a public environmental awareness program that addressed all issues of land protection for persons of all ages.

Perhaps Albania's greatest need for land protection called for the practical operation of a comprehensive agricultural extension program. During the collective era, technical information had been transferred from research institutes to managers of the state or cooperative farms; with privatization and land fragmentation, the inauguration of an extension program became imperative. At the time of study, there were two proposals for agricultural extension programs in Albania. The USAID-sponsored Study for the Agricultural Reorganization of Albania (SARA) had recommended the complete restructuring of the Ministry of Agriculture and Food (MOAF) and the establishment of a separate institute for agricultural extension, which would operate in close linkage with the Agricultural University of Tiranë.

The European Community (EC/PHARE)-developed extension program, initiated in the MOAF in September 1994, encompassed pilot programs in six districts with abundant arable land; the program was later expanded to twelve districts. The goal of the EC/PHARE program was to train farmers in cropping patterns and economics; protecting against soil erosion was a priority of the program, which did not approach land protection as a specific issue. EC/PHARE is now cooperating with the Land Research Institute (Vangjo Kovaçi) on a soil erosion demonstration study. Similar demonstration programs could be organized to show the effects of desalinization on crop production and of composted municipal solid waste on the growth of hybrid tree species to be used eventually for firewood.

The potential for agroforestry in Albania could also be explored. EC/PHARE prepared leaflets that described good farming techniques, and its staff was willing to distribute similar LPAP flyers concerning land protection methods. EC/PHARE was also preparing instructional manuals for use in two-year vocational-agriculture schools; it would welcome the addition of a manual on land protection.

At the time of study, there was no comprehensive public awareness program in Albania. The Ministry of Health's CEP had three directorates, one of which was responsible for developing a national information system that included environmental education *and* environmental impact assessment (with only one staff member, the directorate was clearly understaffed). To be effective, an environmental awareness program must reach adults and children of all ages, and Albania had much to learn in this regard. There was no environmental education

curriculum, for instance, in Albania's public schools at the time. Examples of programs that could be adapted included the U.S. National Science Foundation "Bottle Biology" program, which recycled plastic 1-liter bottles to demonstrate principles of biology and environmental protection, and the Costa Rican model for educating children in protecting the environment. A national environmental awareness program, moreover, could take advantage of the importance Albanian's place on printed material (newspapers and magazines), radio, and television. With the assistance of the Ministry of Education or a private photographer, the LPAP Working Group itself could produce a public television or classroom video showing the problems of land degradation and the need for environmental protection in Albania. Workshops and seminars could be coordinated by the Agricultural University of Tiranë and Korçë University.

3.4 ENVIRONMENTAL LEGISLATION

The Massey report (1995) reviewed existing laws in Albania and summarized land protection laws effective at various government levels in other countries. There was need for other laws protecting groundwater and irrigation water quality, guarding riverbeds from gravel mining, and controlling small-scale, on-site wastewater disposal. According to one MOAF official, there was immediate need for comprehensive legislation on land use as well as environmental protection before a land market law was instituted. "[E]nvironmental problems exacerbate poverty in many rural areas and have significant applications in urban areas ... an environmentally benign development strategy should be a major underlying objective of the Government's overall strategy for economic transition" (1993, Council of Environmental Protection, Ministry of Health, Tiranë, p. 2).

The law "On Environmental Protection," approved by Parliament in January 1993, was derived from an analysis of legislation in European countries under consultancies with the World Bank and the United Nations Environmental Programme (UNEP). The law's goals were prevention and reduction of pollution, conservation of biodiversity, rational management of natural resources, avoidance of over-exploitation, ecological restoration of damaged areas, and maintenance and improvement of the environment. The law could have significant impacts on the environment and human health since it required an environmental impact assessment (EIA) for all projects and activities. There was minimal enforcement of Albania's laws, however, during this time of governmental transition.

The CEP had a legal branch with responsibility for drafting laws on environmental protection. The USAID-sponsored American Law Project was writing laws for Albania, but there was no way to establish whether the issue of environmental protection was being addressed. Assistance in drafting laws was apparently available, without cost, from the Environmental Law Institute, a nonprofit organization headquartered in Washington, D.C.

3.5 LAND INVESTMENT PROGRAM

Incentives could be offered to natural resource users to protect Albania's environment. Examples of incentives that might protect and restore environmental quality are given in the following paragraphs.

Deforestation. Tree seedlings could be available at minimal cost to farmers for reforesting about 100,000 hectares of land that had been cleared during the previous administration.

Soil erosion. Communities could be encouraged to form "Soil and Water Conservation Komuna." The government would share the cost of fertilizers and mechanical equipment with the *komuna* adopting conservation practices such as contour plowing, strip cropping, grassed waterways, and minimum tillage. Tax breaks could be given to farmers for seeding and for not cultivating or overgrazing highly erodible land.

Inadequate drainage of former reclaimed land. There was some question as to whether land in the lower coastal plain that had been reclaimed during the previous administration could be rehabilitated. Restoration was recommended in this instance because of the high cost of maintenance and replacement of drainage channels and pumps and the interest in restoring these wetlands for migratory wildfowl. If the government chose to invest in rehabilitation of these lands, a *komuna*-coordinated program could be initiated for regular cleanup of the channels with government-supplied equipment. The government could also carry the cost of pump replacement.

Salinization. Approximately 13,000 hectares of soils had become salinized because of a rising water table enriched with seawater and repeated rounds of irrigation with salty water. Free soil testing for soluble salts (a simple test using an inexpensive conductivity bridge) could be offered; gypsum, used in the remediation of these soils, could be made available at a nominal cost.

Municipal solid-waste disposal. Expertise on municipal solid-waste disposal could assist Albanians as soon as possible in devising a comprehensive energy conservation and recycling program. Recycling plants, established

by private enterprise with some governmental support, could recycle aluminum, ferrous metals (especially abandoned automobiles), paper products (newspapers, corrugated cardboard, and office paper), glass, plastics, and discarded tires. Paper products, for example, could be composted and sold to farmers as organic fertilizer. Discarded tires could be shredded and used with asphalt for constructing roads.

Contamination of soil and water by agrochemicals. Proper use of agrochemicals could result from extension programming. Awards could be given to the farmers who use the "best management practices" (BMPs), which avoid soil and water contamination by pesticides and chemical fertilizers.

4. LAND INFORMATION SYSTEM

Detailed information on Albania's natural resources had been collected at various institutes. In addition, there were high-quality maps for forest, topographic, climatologic, and hydrologic resources. However, few of the data had been digitized, and few reproducible maps showed the disparity between the potential and the actual extent of land degradation, particularly in high-risk areas. At the time, the data were stored in notebooks, which remarkably had survived the 1990/91 government reform. It was essential that these data be scanned and archived on computer. This, however, would require that the number of computers be increased for LPAP-cooperating institutes, that networking capabilities be established for electronically upgrading information files, and that a Land Information System (LIS) be established in the MOAF, possibly in the Land Directorate. A Geographic Information System (GIS) would be needed to prepare a base map. From the electronically stored data, the GIS could be used to construct maps that show the geographic distribution of various forms of land degradation, especially areas of high risk.

5. FINANCIAL ASSISTANCE

There were several immediate needs for financial assistance: (1) development of the LIS (computers, GIS, training, and some staffing); (2) introduction of an environmental awareness program (EAP); and (3) management of soil and water quality by the Land Research Institute (LRI), of changes in land use by the Forest and Grazing Research Institute in rural areas and the Urban Planning Institute in urban areas, and of meteorological and hydrological conditions by the Hydrometeorology Institute.

Since the IPRS-PMU had insufficient funds to support this work, additional monies had to be solicited from the EC, SARA, and other sources. The role of the Land Research Institute in the LPAP is specified in Annex 5.

6. IMPLEMENTATION OF ACTION PLAN

Proposed LMAP action included establishment of equipment and facilities, needed research, extension and legislation, and land degradation control. Annex 6 provides a timetable for implementing the proposed action. The most pressing needs were for equipment and facilities: additional computers, basic laboratory equipment and supplies for the LRI, networking capabilities for institutional data sharing and international communication, and a CD-ROM abstracting service. It was essential that national maps be prepared to show the various forms of land degradation, particularly in high-risk areas. LPAP and its member institutes should begin preparing brochures that emphasize the consequences of uncontrolled deforestation, grazing, and soil erosion as well as pollution and urban expansion. Comprehensive legislation for controlling land use and protecting Albania's land base had to be enacted prior to land market legislation.

ANNEX 1. SUMMARY OF TECHNICAL LAND RESOURCE DATA FOR ALBANIA

In responding to the need of the Project Management Unit (PMU) of the Immovable Property Registration System (IPRS) to develop a comprehensive plan to preserve the land resources of Albania, it was necessary first to analyze technical data that recorded land resources in the country. It was found, however, that although there was ample literature on the issue of land tenure, there were few technical details available on land resources in Albania. This summary records various specifics on the land resources of Albania from the data that were accessible to an investigation undertaken in January 1995.

PHYSIOGRAPHY AND TOPOGRAPHY

Land satellite imagery for Albania existed at a scale of 1:250,000, with 3 photos covering the entire country. By January 1995, the PMU had prepared 1:5,000 aerial photographs and 1:2,000 parcel maps for the land registration program.

In addition to a national topographic map at a scale of 1:250,000, there were topographic maps at a scale of 1:50,000 for each of the former 26 districts (10 districts were subdivided at the end of the collective era, so there are now 36 districts). Physiographically Albania can be divided into 3 broad provinces, which extend roughly north to south; these included the western lowlands or coastal plain, the central uplands or dissected piedmont, and the eastern highlands or mountains.

BEDROCK AND SURFICIAL GEOLOGY

In 1983, the Albanian Ministry of Mines, the Geologic Institute, and the Petroleum Institute had produced a national bedrock geology map at a scale of 1:200,000. However, there were no detailed bedrock geology maps of various districts nor were there surficial geology maps. About two-thirds of the country is underlain by sedimentary rocks, primarily limestone with some sandstone flyash; the remaining one-third is comprised of igneous rocks, including volcanic rocks and serpentinite. The surficial deposits include glacial sediments in the northern Albanian Alps; colluvium throughout much of the uplands and highlands; and alluvium, lacustrine, and marine deposits in the lowlands.

CLIMATOLOGY AND VEGETATION

In January 1995, there were 208 weather stations distributed throughout the country for monitoring maximum and minimum temperature and precipitation. The International Fertilizer Development Center (IFDC) had digitized data collected from these stations over the past 20 years and produced 1:500,000 maps showing annual rainfall and temperature. Rainfall varied from under 1,000 mm in the Lushnjë District to over 3,000 mm in the northern area of the eastern highlands. About 80 percent of the precipitation fell during the period November through February. The mean annual temperature varied from under 6^{O}C in the northern highlands to over 14^{O}C throughout the eastern lowlands.

As part of its Crop Yield Surveys, the IFDC had produced a land-use map of Albania at a scale of 1:500,000 and more detailed maps (1:50,000) of each prefecture. Thematic maps at scales of 1:10,000 to 1;25,000 were prepared by the IFDC for selected areas. According to the most recent survey (1994, IFDC, "Summary Report") in January 1995, 23 percent of the country (662,000 ha) was arable, 15 percent (430,000 ha) was in pasture, 38 percent (1,044,000 ha) was forested, and 20 percent (620,000 ha) was unproductive land. The remaining areas were occupied by military installations (1.1%), lakes (2.0%), major cities (0.3%), and the like (0.7%). In 1993, the dominant arable crops included winter wheat (155,233 ha), maize (114,475 ha), and alfalfa (45,815 ha). Tree crops (118,455 ha) included vineyards, orchards, and olives.

The Albanian Forestry Research Institute had 1:50,000 maps of forest- and pastureland. Maquis (evergreen Mediterranean scrub) grew below an elevation of 300 meters. Mixed oak forests (*Quercus* spp.) occupied the lowlands from 300 to 1,000 meters (32.4% of forest area), with beech (*Fagus sylvatica*) and chestnut (*Castoria sativa*) occurring at intermediate elevations (17.3% of forest area), and conifers at elevations above 1,800 meters (16.8% of forest area). The dominant coniferous species included black pine (*Pinus nigra*), Balkan white pine (*Pinus* spp.), and Macedonian fir (*Abies* spp.). The remaining 33.5 percent of forestland contained mixed broad-leaved species, including maple (*Acer* spp.), ash (*Fraxinus* spp.), elm (*Ulmus* spp.), beech, and oak. Covering a diversity of environments, Albania contained 3,200 plant species, 489 of which occurred only in the Balkans, and 40 of which occurred only in Albania.

WATER

The average water flow in Albania was 42,000 million cubic meters. Hydropower facilities on the 11 major rivers provided 82 percent of the nation's electricity. Lakes occupied 58,362 hectares. Only 5 percent of the water used for irrigation originated from groundwater; 95 percent came from the 650 reservoirs.

SOILS

The Soils Research Institute (SRI), later known as the Land Research Institute or LRI, of the Ministry of Agriculture and Food (MOAF) produced a national soil map at a scale of 1:200,000. This map is based on the zonal Russian system and is strongly dependent on topography, climate, and vegetation. The map contains 12 soil types and 18 sub-types. These maps are colored by hand and are of limited distribution. The IFDC had digitized this map and converted the legend into the FAO/UNESCO soil map units. There are 17 soil units in the new legend. The soils of Albania include Fluvisols, Lithosols, Rankers, Rendzinas, Vertisols, Cambisols, and Luvisols, with lesser areas of Halomorphic soils (Solonetzes and Solonchaks) and Histosols.

Dr. Pandi Dzruli of the SRI was digitizing the national soil map and converting the legend into *Soil Taxonomy* (ST), a global system of soil classification that is useful for land-use interpretations and necessary for crop modeling. This work was being done in cooperation with the World Soil Resources, U.S. Department of Agriculture, and Soil Conservation Service (now the Natural Resources Conservation Service). However, there were no copies of this map available in Tiranë. It is likely that the dominant soils in Albania according to ST are Haplaquelts, Xerolic Ustolls, Xererts, Xerochrepts, and Ustalfs, with lesser areas of Natriborolls, Aquisalids, and Histosols. In March 1994, in cooperation with the U.S. Soil Conservation Service the SRI collected samples from 17 pedons (soils) throughout Albania. Complete characterization of the samples was done by the U.S. Department of Agriculture National Soil Survey Laboratory in Lincoln, Nebraska.

The SRI had also prepared soil maps at a scale of 1:50,000 for each of the former 26 districts. The maps, again, were based on the Russian approach to soil taxonomy but had been upgraded. The IFDC was in the process of digitizing the maps and converting the legend into the FAO/UNESCO soil map units. These maps could be converted into *Soil Taxonomy* for land-use interpretations and crop modeling.

Apparently, agricultural suitability maps had been made at a scale of 1:10,000 for some of the former collective farms, but they could not be found.

Few Albanian technical natural-resource publications were obtainable. Either only a few copies were available or clearance had to be provided for their use. The SRI had also prepared guidebooks to assist the former collective farms in selecting fertilizer, reclaiming saline and sodic soils, managing ultramafic (serpentinitic) soils, managing soils for fruit trees, and choosing irrigation methods. Soil survey reports were available for each of the former 26 districts; these reports contained descriptions and analytical data for each soil taxon, a 1:50,000 soil map, and interpretations on the suitability of soils for agricultural crops.

In 1988, all of the agricultural soils data had been analyzed as part of a land evaluation program. That study included data from 684,497 hectares (24% of the country) of agricultural land. Areas were given for broad textural groups, soil depth class, salinity class, pH class, ultramafic conditions, and stone content class in each district. In addition, district percentages were shown by soil organic matter class, total soil nitrogen class, extractable soil phosphorus class, and exchangeable soil potassium class. For example, 36 percent of the agricultural soils had "heavy" clay (>50% clay), 11 percent were less than 40 cm deep, 2 percent were saline or sodic, 2 percent were ultramafic, 11 percent were stony ($\exists$15% coarse fragments), 44 percent had #1.5 percent organic matter, 37 percent were nitrogen deficient, 33 percent were low in phosphorus, and 8 percent were potassium deficient.

Based on numerical weighting of soil properties, slope class, and climatic parameters, 10 land evaluation classes had been established by the SRI. Classes I through III included the most productive agricultural soils; class IV contained moderately productive soils that could be enhanced with fertilizers, lime, and/or irrigation; classes V and VI were marginally suitable for cultivation; and classes VII through X were generally unsuitable for cultivation. Of the agricultural land, 40 percent (277,221 ha, or 10% of the total land area) contained class I to IV soils.

Although there were abundant data on arable soils, there were limited data for soils in pasture or forest. According to personnel in the Forestry Research Institute, soil characterization data were available for approximately 40 percent of the land that had been afforested prior to 1990 (about 72,000 ha).

LAND DEGRADATION MAPS

As of January 1995, there had been no attempts to construct maps depicting the area distribution of land degradation, such as soil erosion rate, potential hazard for landslides, susceptibility to flooding, risk of groundwater contamination, and chemical soil pollution by industry. These maps could be constructed from overlays of land resource maps using geographic information systems (GIS).

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ANNEX 2. MINUTES OF THE LAND PROTECTION ACTION PLAN (LPAP) MEETING OF 13 MARCH 1995

The first meeting of the LPAP Working Group was held on 13 March 1995, and was chaired by Albert Dubali, Head of the Land Policy Department of the Project Management Unit, Immovable Property Registration System. Oral reports were given by representatives of the following organizations: (1) Land Research Institute (Dr. Sulijman Sulçe, Director), (2) Forest and Pasture Research Institute (Spiro Karaduni, Director), (3) Hydrometeorology Institute (Tekif Jegemi, Specialist), (4) Institute for the Study and Design of Waterworks (Arqile Prifti, Specialist), and (5) Committee on Environmental Quality and Health (Ermal Hamili). Although an invitation was given, a representative of the Urban Planning Institute was not at the meeting.

The following individuals also attended the meeting: Dr. Richard Affleck, U.S. Department of Agriculture (USDA), Office of International Cooperation and Development; Dr. Hari Eswaran, USDA, World Soil Resources; Dr. James Bockheim, Terra Institute, Ltd., and Institute for Environmental Studies of the University of Wisconsin; Mr. Pandi Zdruli and Kol Cara, Land Research Institute; Dr. Harvey Jacobs, Land Tenure Center, University of Wisconsin; Idriz Xhamara, Director, Land Directorate, Ministry of Agriculture and Food; and Patriot Çobo, Director, Natural Resources Institute.

Mr. Dubali requested that the representative for each institute identify key land degradation problems, what technical information has been collected and is needed, and what laws have been written and are required.

Dr. Sulijman Sulçe, Director of the Land Research Institute, reiterated the need to compile existing data and maps because considerable work has already been done on some of the land degradation problems. However, there are insufficient data on soil and water contamination by pesticides, fertilizers, and heavy metals; the Institute of Hygiene should be involved in these studies. He also stressed the need for geographic information systems (GIS) for preparing actual and potential environmental hazard maps.

Mr. Idriz Xhamara of the MOAF Land Directorate identified deforestation, soil erosion, and mass wasting as the major problems facing Albania's food security and said that soil and water pollution problems should be de-emphasized.

Mr. Spiro Karaduni of the Forestry and Pasture Research Institute suggested that previous reports did not sufficiently emphasize forestry-related problems in Albania. Forests and pastures cover 36% and 14% of the country, respectively. Forest degradation increases soil erosion that, in turn, causes damage to streams and reservoirs and reduces agricultural production. The Institute has data on the extent and rate of soil erosion on forest- and pasturelands. The World Bank has identified high-risk areas of erosion on a 1:200,000 scale map and has suggested emergency steps to be undertaken to mitigate the problem. Mr. Karaduni pointed out that 290,000 hectares of forestland have been cleared for agriculture since 1953. He said that a key research topic should be the hydrologic study of the Drini watershed, an area that has been identified for potential tourism but which is subject to flooding and sedimentation of reservoirs. Another key research topic is the effect of deforestation and overgrazing in hilly and mountainous areas of northern Albania on subsequent flooding of coastal areas downstream.

According to Mr. Tekif Jegemi, the Hydrometeorology Institute maintains over 200 meteorological stations and is responsible for water supply and quality issues. According to data collected by the Institute, the average precipitation for Albania is 1,000 mm, with a range of 600 to 3,000 mm. The maximum intensity of rainfall recorded over a 24-hour period was 400 mm; total rainfall of 257 mm was recorded over a 1.5-hour period in 1946. Mr. Jegemi suggested that the Working Group cooperate with an American Defense Mapping Agency team that is working with the Albanian military to produce 1:10,000 scale maps showing the risk of soil erosion. His Institute is especially interested in cooperating with other organizations on rehabilitating flooded land in the lower coastal plain. Mr. Jegemi suggested that another key problem is the removal of gravel from riverbeds, banks, and even dikes. Since this action is under the jurisdiction of the Ministry of Industry, Mr. Prifti suggested that a representative from this organization be appointed to the Working Group.

H. Eswaran stated that the most important function of the Working Group was to assemble all available data on natural resources and their degradation and that the data should be formatted and stored on computer.

According to Mr. Arqile Prifti, the Waterworks Institute is responsible for the design and maintenance of reservoirs and drainage and irrigation channels. Since 1947, over 600 reservoirs have been built for supplying irrigation water. Mr. Prifti agreed with previous speakers that soil erosion was a key problem because of the sedimentation of reservoirs and irrigation channels. His Institute is working with the World Bank on rehabilitating

irrigation channels in several areas. He suggested that key research subjects are to monitor quality of irrigation water and to design irrigation systems. For example, 95 percent of the irrigation water is supplied by gravity, which may cause sedimentation of drainage channels, and few repairs have been made on these drainage channels in the past 6 years. According to A. Dubali, pumps that were installed to remove excess drainage water during the winter, when heavy rainfall is most apt to occur, now operate at full capacity year-round. Mr. Prifti observed that much of the land reclaimed during the past 30 to 40 years by draining coastal wetlands is reverting to its earlier condition. He suggested that the World Bank might be interested in rehabilitating drainage as well as irrigation channels. He also was concerned about the removal of gravel from river channels and riverbeds; in Elbasan, for example, flooding has been exacerbated by the removal of gravel from the banks of the Shkumbini River.

Mr. Prifti's said that laws should require chemical analysis of irrigation water for pesticides, fertilizers, heavy metals, and salts. He also suggested that laws dealing with erosion should require that the cost of sedimentation in reservoirs be added to the cost of land protection rather than the cost of irrigation water.

During the question and answer period, Mr. Prifti mentioned that no single organization is currently responsible for the protection of Albania's groundwater resources. He noted that pollution of water with salts, fertilizers, and pesticides has decreased in the last several years because of less intensive farming methods, but that the presence of heavy metals in drinking water is of concern.

Mr. Ermal Hamili of the Committee of Environmental Protection (CEP) said that his Committee, which is composed of 10 to 12 persons from various agencies reporting to the Ministry of Health, has 3 directorates or subcommittees: (1) protection of water and air quality, (2) advertisement of environmental issues, and (3) natural resource conservation and land rehabilitation. The CEP itself cannot deal with environmental problems but must work through the appropriate organizations. Standards for air and water quality are established by the CEP.

H. Eswaran discussed the recent shift in emphasis of the USDA Natural Resource Conservation Service (formerly Soil Conservation Service) from crop to environmental protection when dealing with the issue of soil quality. The agency has recently established a Soil Quality Institute to address the specific issue of soil quality and its relation to water quality. He suggested that, though monitoring of water quality is important, mechanistic models might reduce the intensity of monitoring efforts.

Mr. Pandi Zdruli of the Land Research Institute, who has been working with Dr. Eswaran in the United States, displayed 1:400,000 scale maps of the soils and climate domains of Albania. The soil map was produced by digitizing the 1985 Albanian soil map and converting the legend to taxa as defined in *Soil Taxonomy*, a global system developed in the United States. Map unit delineations were refined from a sampling of 17 pedons (soil bodies) and 59 observation points. The soil climate map was generated using data from the Hydrometeorology Institute and geostatistics. Mr. Pandi Zdruli presented a copy of the two-volume report, *Benchmark Soils of Albania*, dated March 1995. The first volume discusses the natural resources of Albania, giving a description of the soil map units, maps, and some analytical data. The second volume provides detailed soil descriptions and laboratory data. P. Zdruli has also prepared 1:50,000 scale maps of Korçë District, including soil depth, erosion hazard, chemical pollution, and soil taxa; he would like to prepare 1:50,000 scale soil maps of each of the former 26 districts. He agreed to furnish the Land Research Institute with a scanner so that it could prepare additional maps.

The Working Group was concerned about resources available to complete these tasks, for it will take considerable expense and labor to assemble and computerize these sets of natural resource data. A. Dubali agreed to address this concern. Working Group attendees were asked to identify the persons who will represent their respective organizations at subsequent meetings. A. Dubali requested that each agency provide maps and data for examination at the next meeting, 20 March 1995.

ANNEX 3. OBSERVATIONS ON LAND DEGRADATION IN ALBANIA

Through consultation with Albanian administrators and scientists, several types of land degradation needing immediate attention were identified: excessive soil erosion, landslides, flooding of formerly reclaimed land, deforestation, improper disposal of municipal solid waste, contamination of soils, contamination of surface and groundwater, salinization of soils and irrigation water, and urbanization on prime farmland. During March 1995, land degradation in Albania was observed and analyzed in order to assist the Project Management Unit of the Immovable Property Registration System with its preparation of the Land Protection Action Plan (LPAP). [In Albania, in March 1995, the observation team included the specialist advisor accompanied by Drs. Fioreta Luli and Valentina Suljoti of the Land Research Institute and an interpreter, Mr. Perlat Sula.]

In Fier District, a person had illegally occupied high-quality farmland. The occupant was only marginally interested in farming and was counting on the value of the property, positioned along the Rruga-to-Fier highway, to increase rapidly as the roadway was upgraded. He said that there was little incentive to continue farming since importing vegetables from Greece was less expensive than growing them.

Also in Fier District, flooding from sedimentation was seen in drainage channels in reclaimed land on the coastal plain as well as pollution of these channels from oil drilling. At Hoxhara, salinized soils were found on a former state farm. Although some of these soils were saline prior to reclamation because of the presence of brackish seawater, many had become more saline due to sustained irrigation with salt-enriched water and were no longer able to support crops. Soils that had been drained and treated with gypsum and organic fertilizers were moderately productive.

North of Fier, petrol pollution was seen in Vija e Ngjalës (Eel River) and a 100-hectare landfill was discovered that remained uncovered, was grazed by pigs, and had extended into the river.

On the outskirts of Tiranë, two research sites were inspected. At Sharra (Sauk), urban development on agricultural land had been abandoned because of massive degradation, excessive sheet erosion, and gully erosion. Soil loss resulted from the removal of native woody shrubs (maquis, used for firewood) from steep, south-facing slopes made up of claystone enriched with montmorillonite, a type of clay that is subject to shrinking and swelling with changes in moisture content. Erosion on north-facing slopes was due to terracing during the collective era and overgrazing among the olive trees, which then perished. A reservoir to supply irrigation water to arable land had been created at the head of the valley, but the land was then used for grazing because the pump did not work and the farmers could not afford the pipes.

At Kamëz (Kamsa), unauthorized settlement had produced many sociological and environmental problems. For example, fruit trees on a former state farm had been damaged and cut for firewood, and drinking water obtained from wells was likely contaminated due to the lack of sanitary facilities. Settlement along the Tiranë River was situated on a low terrace, was subject to flooding, and contributed to clogging the river with municipal solid waste. Some suburban development was occurring on nearby land, which was subject to sinking from the collapse of underground coalmines.

Gravel was mined from riverbeds and riverbanks and, in some cases, from dikes built to keep out the sea. Apparently there was no legislation to restrict this activity, for a large-scale, Italian commercial river-gravel mining operation was sited on the Tërkuza (Rope) River.

Laç, which is the most polluted city in Albania, was situated along the way toward Rubik. Many of the city's manufacturing factories produced phosphorus fertilizer, which includes treatment of pyrite with concentrated sulfuric acid, inducing the release of strongly acidic byproducts directly into the Fani (Mud) River.

The Fani River was also subject to severe flooding. Although natural to the region, flooding had become more frequent and severe because deforestation and landslides had triggered the loss of absorbing soil cover. At Rubik, the Fani River received direct discharge of byproducts from the processing of copper ore, the water turning green due the copper sulfate. Sulfuric acid mist and sulfuric dioxides were released into the atmosphere as well during the processing of the copper ore, the discharge adversely affecting human health. Although local people had complained about air and water pollution, the Ministry of Health has taken no action.

ANNEX 4. LIST OF CONTACTS

IPRS-PROJECT MANAGEMENT UNIT

Albert Dubali, Chief, Land Policy

MINISTRY OF AGRICULTURE AND FOOD

Llazar Korra, Head, Agriculture Project Office

LAND DIVISION

Idriz Xhamara, Chief
Patriot Çobo, Director, Natural Resources
Tatjana Hima Dishnica, Director, Science and Information

SOIL RESEARCH INSTITUTE

Sulijman Sulçe, Acting Director
Sherif Lushaj, Chief, Soil Chemistry Department
Kol Cara, Specialist, Pedology
Bardhy Qilimi, Specialist, Soil Chemistry
Fioreta Luli, Specialist, Geology and Soil Mineralogy
Valentina Suljoti, Specialist, Soil Chemistry
Vangjo Kovaçe, Specialist, Soil Chemistry
Skënder Belalla, Specialist, Soil Chemistry
Pandi Zdruli, Specialist, Pedology

UNIVERSITY OF WISCONSIN–MADISON LAND TENURE CENTER

Harvey Jacobs, Urban and Regional Planning
Eve Yanda, Urban and Regional Planning

FOREST AND PASTURE RESEARCH INSTITUTE

Spiro Karaduni, Director

HYDOMETEOROLOGY INSTITUTE

Eglandtina Demiraj, Vice-Director
Tekif Jegemi, Specialist

INSTITUTE FOR STUDIES AND DESIGN OF WATER WORKS

Selman Zala, Director
Arqile Prifti, Specialist, Irrigation
Bardyl Aliko, Specialist
Nexhat Gjinali, Specialist

SUPPORT FOR AGRICULTURAL RESTRUCTURING IN ALBANIA (SARA)

David Kunkle, Senior, Agricultural Policy and Research
Dan Taylor, Advisor, Agricultural Economics

COMMITTEE OF ENVIRONMENTAL PROTECTION

Gani Deliu, Vice Chair
Ermal Hamili, Specialist

INTERNATIONAL FERTILIZER DEVELOPMENT CENTER (IFDC)

Ray Diamond, Chief of Party, Albania

EUROPEAN COMMUNITY/PHARE

Valdona Ylli, National Coordinator, Extension Service
Winn Beijer, Extension Advisor, Agricultural Extension Development Programme

U.S. DEPARTMENT OF AGRICULTURE

Hari Eswaran, World Soil Resources
Richard Affleck, Office of International Cooperation and Development

ANNEX 5. ROLE OF THE LAND RESEARCH INSTITUTE

The Land Research Institute (also called the Soil Research Institute and formerly named the Institute for the Study of Soils) is the primary institute responsible for conducting research on agricultural land in Albania. Substantiating its performance as the lead agency in protecting Albania's land resources called for some initial analysis. In this review, Dr. Tatjana Hima Dishnica, General Director of the LRI, requested expert evaluation of LRI scientific publications, suggestions of research especially relating to land privatization, and an outline of proposed methodology for undertaking the land protection research. The LRI operates under the authority of the Albanian Ministry of Agriculture and Food (MOAF), which controls its finances and already cooperates with the PMU.

BACKGROUND

The mission of the LRI during the centralized regime was research. Formal teaching was performed at the universities and there was little need for extension programs. The LRI carried out all research investigations for Albania's 115 state farms and 460 collective (cooperative) farms. Its staff members, however, had little prospect to determine specific lines of inquiry, for the central government dictated the direction of all research. The staff also maintained minimal contact with foreign countries, other than the former Yugoslavia, the People's Republic of China, and the former Soviet Union; had no access to and no right to publish in journals produced outside of Eastern Europe and Asia; and had few opportunities to attend international meetings.

Research completed during this era included: (1) a national soil map a the scale of 1:200,000, based on the Russian genetic, zonal approach to soil taxonomy; (2) soil survey reports for each of the former districts, including descriptive and analytical data on each soil taxon, maps at 1:50,000 scale, and interpretation of agricultural suitability; (3) soil characterization data for 17 pedons (soils); (4) detailed, 1:10,000-scale maps of agricultural suitability for some collective farms; (5) systems of land evaluation for agricultural productivity; and (6) guidebooks for recommending fertilizer, reclaiming saline and sodic soils, managing ultramafic (serpentinitic) soils, managing soils for fruit trees, and irrigating crops. (See also Annex 1 for technical material.)

The national soil map was not readily available; only a limited number had been produced. Although the national map contained descriptions of 12 soil types and 18 sub-types, it had limited use for land-use interpretation because it was strongly dependent on topography, climate, and vegetation, and not on measurable soil properties. The soil survey reports contained fundamental data by district, including soil descriptions and analytical data, which could be used for interpreting land use and modeling crop growth. The maps in these soil survey reports were also based on the Russian system; they were subsequently upgraded during the 1980-85 period. The soil survey data and maps could be used for identification in the FAO/UNESCO soil map ledger, but were insufficient for classification in *Soil Taxonomy*, a global soil taxonomic system developed in the United States. The land evaluation system was similar to the agricultural capability classes used in soil survey reports in the United States.

In 1991, the centralized government of Albania was replaced by a democratic government. The 460 collective farms and 115 state farms were subdivided, releasing approximately 612,000 hectares of agricultural land to be apportioned among 480,000 private farmers. Each private farmer received about 1.3 hectare of land, which was divided among 3.3 parcels.

In 1995, the LRI occupied a 3-story building containing both offices and laboratories; it was located in the southwestern suburbs of Tiranë. The Institute had 3 divisions or departments (4 divisions prior to 1992): (1) Soil Physics, (2) Soil Chemistry and Plant Nutrition, and (3) Soil Cartography and Surveying. The staff comprised 18 scientists, all of whom had Ph.D. degrees and most of whom were trained at the Agricultural University of Tiranë.

Seven of the scientists, including the former director, Dr. Albert Dubali, were working for the PMU. The Soil Physics Department investigated soil genesis and classification, soil mineralogy, soil physics, soil erosion control, soil tillage, irrigation, and drainage systems. The Soil Chemistry and Plant Nutrition Department conducted fertilizer trials and studies on plant nutrition, analyzed the composition of agrochemicals, and detected pollutants in soils. The Soil Cartography Department was more directly involved with the PMU. The LRI also had a technical (publications) section, a chemical laboratory, a mushroom production section, and a "bacterium fertilizers" section. It maintained 3 (formerly 8) agricultural experiment stations, in Tiranë, Lushnjë, and Shkodër, and soil testing laboratories in each of the former districts.

The transition period was been difficult for the LRI. There was insufficient funding to support research, with the exception of studies on: effects of urbanization and the loss of highly productive agricultural land in the Tiranë area; nitrogen dynamics in agro-ecosystems; heavy metal (Pb and Cd) contamination of soils from industrialization and urbanization; soil erosion in relation to vegetational cover, relief, climate, and tillage practice; and effects of sedimentation in drainage channels on flooding of coastal lowlands.

EVALUATION OF THE LAND RESEARCH INSTITUTE

The LRI employed capable scientists who were eager to carry out research but lacked the financial and institutional support to conduct competitive investigations in an international market. Its physical facilities, however, both building space and laboratory instrumentation, were inadequate. In 1995, the following conditions characterized the LRI.

- The LRI building was in poor condition, lacked central heating, was subject to daily power outages, and had no running water after 4 a.m. Basic laboratory equipment (with year of purchase in parentheses) included: one pH meter (1972), one nonfunctional conductivity meter (1972), one spectrophotometer in the visible light range (1972), one atomic absorption spectrophotometer, which could be used because acetylene gas was not available (1976), one emission spectrograph (1974), one petrographic microscope (1972), one spectrophotometer for N^{15} analysis (1982), one flame photometer (1972), and one muffle furnace (1972).
- The LRI technical section or library had laboratory analysis books that were outdated and falling apart from continual use. Its soil scientists had never published in North American and rarely in Western European journals (there were no professional journals in Albania for agricultural scientists' papers).
- The LRI had only one computer, one duplicating machine, and one telephone. It had facsimile (fax) capability but no linkage to Internet. There were no vehicles for soil scientists to access field research sites.
- The LRI scientists had little contact with the International Soil Science Society and in general lacked funding to attend international meetings.

Recommendations for upgrading the Land Research Institute

The LRI could not provide research and extension services or exemplify the process of collecting and analyzing natural resource data for Albania without financial and institutional support. In 1995, the following recommendations for improvement were made.

- The building that houses the LRI should be completely refurbished, including installation of central heating, modern lighting with backup support, and running hot and cold water. In place of a costly distillation unit, a deionization column should be installed for purifying water.
- All new instrumentation would be needed to conduct research and provide technical support to extension personnel. Chemical instrumentation should include a pH meter ($500), a conductivity meter ($500), an atomic absorption spectrophotometer ($18,000), a flame photometer ($5,000 to 8,000), an inductively coupled plasma emission spectrophotometer ($60,000 to $170,000), a spectrophotometer ($3,000), a Lachet Quick Chem 8000 flow injection unit ($30,000 to $40,000), a near-infrared spectrometer ($60,000), and a muffle furnace ($14,000). (The higher value within these cost ranges would enable computer processing of data.) Mineralogical instrumentation should include an X-ray diffraction unit and a soil microscopy laboratory with a diamond saw, grinder, and polisher for preparing thin sections and a petrographic microscope with a camera for taking photomicrographs.
- There should be at least one computer per department until there is sufficient funding to provide each scientist with a personal computer. The computers should be programmed with Internet capability, allowing LRI scientists to exchange information with the international scientific community on a day-by-day basis. Internet

accessibility could well be the most important immediate need at the present time because of week-long delays in the exchange of mail between North America and Albania. The International Computer Company in Tiranë is equipped to advise the Institute on its computer needs.

- The LRI must establish a modern library that is abreast of the latest scientific developments. The Institute could obtain free journals and books from the personal libraries of retiring North American and Western European scientists. There should be subscriptions to the American Society of Agronomy (ASA) journals (*Soil Science Society of America, Agronomy Journal*, and *Journal of Environmental Quality*). [The least expensive method to access international literature is via *Current Contents on Diskette with Abstracts* (Institute for Scientific Information, Philadelphia, Penn.); subscription to the component version, "Agriculture, Biology and Environmental Sciences," includes a weekly distribution of abstracts from 1,000 journals, on diskette.]
- Funding should be available for each scientist to attend at least one professional, international meeting every four years. The International Soil Science Society, for instance, meets every four years. Lists of meetings are published monthly in the ASA's *Agronomy News*.
- Research in sustainable agriculture and environmental quality could be supported in two ways. First, the MOAF could establish a panel of scientists to determine priorities and provide competitive grants. Second, MOAF could encourage LRI scientists to establish contacts with foreign scientists, who could then supply the funds to conduct research in Albania; the Albanian scientists would provide logistic and technical support and would co-publish the results.

Conclusions

During the centralized government administration, the Albanian Land Research Institute conducted all of the soil mapping, characterization, and interpretation of agricultural land use. Its role became more important as a result of land privatization, because it thereafter provided research and technical support to 480,000 farmers and protected against land degradation, both of which activities would partly determine the country's food security.

The LRI had a well-trained staff and the experience to provide leadership in research and extension in sustainable agriculture and environmental quality. However, for the Institute to carry out these tasks, the following tasks needed to be accomplished: (1) refurbish the building; (2) procure new instrumentation in soil chemistry, physics, mineralogy, and tissue analysis; (3) provide computers, with access to Internet, to each department; (4) obtain technical journals and books for the LRI library; (5) provide financial support so that the scientists could attend professional meetings and interact with the international scientific community; and (6) establish a competitive grants program to provide funding for agricultural and environmental research.

ROLE OF THE LAND RESEARCH INSTITUTE IN THE LPAP

Despite shortcomings, the Land Research Institute was identified as a lead agency in protecting Albania's natural resources. The laboratory facilities at the LRI, however, needed complete rehabilitation, as had been reported by the SARA Project (1994, "Study for the Agricultural Reorganization of Albania," USAID, Washington, D.C.) and others (1995, James G. Bockheim, "A Summary of Technical Land Resource Data for Albania," Terra Institute, Mt. Horeb, Wisc.). The LRI could undertake monitoring of soil and water quality, coordinate multidisciplinary research such as watershed projects, and carry out specialized studies. With upgraded laboratory facilities, the LRI could analyze plant tissues, soils, water, and sludge for other governmental agencies as well as for farmers. Funding for improving the laboratories could be sought through "institutional strengthening" grants by the USAID-SARA and the International Fertilizer Development Center (IFDC), with assistance of the MOAF. The LRI could work with the Agricultural University of Tiranë and Korçë University in producing extension leaflets and instructional manuals.

The LRI had close ties with the IPRS-PMU; its former director, Albert Dubali, was head of the PMU's Land Policy Department and three of LRI research projects were supported by the PMU. [These supported projects included studies of the fragmentation and consolidation of agricultural land (Sherif Lushaj), the effect of urbanization on agricultural land (Fioreta Luli and Valentine Suljoti), and the protection and management of agricultural land (Skënder Belalla and Bardhy Qilimi).] It would be desirable if the PMU could support three additional LRI investigations, including chemical pollution of agricultural soils, historical changes in salt accumulation in soils of the lower coastal plain, and a national survey on soil fertility. The latter study could be jointly supported by the IFDC.

The LRI could benefit from an association with the Department of Soil Science at the University of Wisconsin–Madison, one of the leading departments of its kind in the United States. An exchange scientist program could be developed through the University of Wisconsin International Agricultural Program. Emeritus Professor Emmett Schulte has established soil and plant analysis laboratories and extension programs in Nigeria and The Gambia and could do likewise in Albania. Soil science staff who were also members of the university's Institute for Environmental Studies could assist in performing research on natural resource protection.

ANNEX 6. PROPOSED TIMETABLE FOR ACTION PLAN IMPLEMENTATION

Action timeframe	Equipment and facilities	Research	Extension	Legislation
Immediate	Computers, laboratory equipment and supplies, Internet, CD-ROM abstracting service	1:200,000 national maps of land degradation and high-risk areas	Leaflets on deforestation, overgrazing, and soil erosion	Land use and land protection
Short term	Geographic information system	Scan and archive natural resource data	Video program on land degradation	Land market
Intermediate	Laboratory rehabilitation (LRI)	1:50,000 district maps of land degradation and high-risk areas; monitor air, water, and soil quality	Workshops and seminars; manual on land protection	Environmental pollution control standards
Longer term	Office and further laboratory rehabilitation	Watershed study	Primary/secondary environmental awareness program	Rehabilitation of damaged land, toxic waste cleanup