



# The Bureau of Soils and Water Management

*Soil and Water Researches,  
Activities and Generated  
Technologies*





The Training Center has a Convention Hall and 2 Lecture Rooms which have become the common venue for meetings, workshops, local and international conferences on soil and water resources. The Center also caters to major activities of the Department of Agriculture, Bicameral Meetings and significant affairs of other government agencies in both international and national levels.

## **INTEGRATED SOIL RESOURCES INFORMATION SYSTEM**

ISRIS provides computing resources, capabilities and services to the research and survey, special projects, training and information and administration of the BSWM.



Activities such as Geographic Information System or GIS, map digitization and others related to it make up the actual functions of the group. It also provides leadership for the development of a strong computer support to



activities on research, land-use, conservation and management, laboratory and other disciplines in which computer resources can substantially improve the quality appropriateness and effectiveness of these

programs.

- N, P, K, Ca, Mg, Na Crude Silica, Sulfate, Electrical Conductivity, Moisture Content and Trace Elements

### 5. Microbial Analysis of Soil Samples

- Rhizobia, Bacteria and Fungi

#### Available for Sale:

1. Legume Inoculants/*Trichoderma*
2. Soil Test Kits - for N, P, K and pH
3. Rapid Soil Test - for Ca, Mg, Zn, Fe, and S

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## TRAINING AND INFORMATION DISSEMINATION SERVICES

Translating the technologies in a language easily understood by the farmers is the main responsibility of the Training and Information Dissemination Services (TIDS). Equipped with sophisticated audio-visual and editing facilities through the Japan International Cooperation Agency (JICA) Project, the TIDS develops and packages soil and water-related information into multi-

media materials – video documentaries; primers and brochures and photo-technological exhibitions among others. The capability of its facilities enabled to provide video production and documentation to the Department of Agriculture and some of its bureaus.

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## The BSWM Performance Team

The *BSWM Performance Team* is composed of dedicated men and women from various disciplines – the Soil and Water Resources Research; the Laboratory Services; Water Resources Management; and the Agricultural Land Management Evaluation Division. It has provided and operationalized programs and services towards the enhancement of food production and the promotion of rural development, to wit:

- Tamang Abono Program (TAP)  
Balanced Fertilization Strategy (BFS)  
Modified Rapid Composting
- Small Water Impounding Project (SWIP)
- Rapid Soil Testing (RST)
- Regional Services of the Soil and Water Area Coordinators (SWAC)

The TAMANG ABONO Program (TAP) is a two-pronged strategy that both addresses the high cost of farm inputs (e.g. fertilizer) and making agriculture available for the present and future generations. It is an integrated program to address the high cost of fertilizer and promote sustainable agriculture. It has two project components: the



National Organic Agriculture Program (NOAP) and the Agri-Kalikasan Program. These two projects are in accord to diminish, if not eliminate, the high dependence on synthetic chemical inputs –that has impacts on the socio-economic and environmental conditions of the agriculture industry.

Due to the increasing concern to have a holistic and

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analysis of Lime, Zinc, Calcium, Magnesium, Sulfur, Ammonium and Nitrate.

In conjunction with the regular Soil Test Kit (STK) that analyzes nitrogen, phosphorus and potassium, the RST is expected to provide a more direct information about the adequacy and deficiency levels of both the major and minor soil nutrients. The information leads to a more precise fertilizer recommendation.

The Division conducts these analyses with accuracy through modern precision equipment. Its staff is updated on new technologies by undergoing much needed trainings, seminars and symposia. In coordination with other BSWM divisions, the Division makes a commitment towards greater farm productivity.

### **Services Offered:**

#### **1. Physico-chemical Analysis of Soil Samples**

- Soil Texture, Water Holding Capacity, Hydraulic Conductivity, Bulk Density, Moisture Retention, Sand Fraction, Atterberg Limit, Available P, Exchangeable Acids, Exchangeable Bases, CEC, Electrical Conductivity, pH, Organic Carbon/Matter, Total N, Ammoniacal N, Nitrate N, Trace Elements, Extractable Aluminum, Free Iron Oxide, Calcium Carbonate

#### **2. Chemical Analysis of Water Samples**

- pH, Electrical Conductivity, Bicarbonate, Carbonate, Sulfate, Chloride, Total N, Ammoniacal N, Nitrate N, Total P, K, Na, Ca, Mg and Trace Elements

#### **3. Assay of Fertilizers**

- Total N, Total P, Available P, Total K, pH, Moisture, Organic Carbon/ Matter, Calcium Carbonate, Ca, Mg, Na, S, Cl and Trace Elements

#### **4. Chemical Analysis of Plant Tissue**

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laboratory normally located in the capital town of a province. Experience shows that it takes at least two (2) weeks before the farmer get his fertilizer recommendation. The time can be shortened and with the introduction of more kits in different farm areas, even farmers themselves can provide service to their fellow farmers.



The STK is an inexpensive, quick, handy and easy to use as soil testing tool. Results are obtained within an hour. It is therefore useful to farmers and extension workers to determine on the spot what kind and amount of fertilizer to use to a grown crop in a given farm.

The STK determine the pH, Nitrogen, Phosphorus, and Potassium. It is a qualitative type of testing and through color comparison, the deficiency or sufficiency of the element can be assessed.

### *Rapid Soil Test Kit for Soil Micro-nutrients*

Rapid Soil Test Kit (RSTK) for soil micronutrients is a simple, low cost and portable soil testing kit. These kits can be used by farmers and agricultural technicians in the field



to identify quickly soil micro-nutrient problems that limit rice and other crop production. The RST also informs the user about the other new analysis required to ensure that location-specific fertilizers are recommended. The RST includes quick field

sustainable agricultural management system, Executive Order 481 –*Promotion and Development of Organic Agriculture in the Philippines*. This provision operates around the principles of fairness, health, ecology and care. With the promotion of organic agriculture, an alternative agricultural production is achieved that avoid the use of inorganic (synthetic) fertilizers and pesticides aimed at preserving the agricultural resource base that minimizes air, soil and water pollution.

On the other hand, in 1997, the Bureau of Soils and Water Management (BSWM) has been mandated through Presidential Proclamation No. 1071 to formulate and implement the Balanced Fertilization Startegy (BFS). In accordance with this, BSWM formulated the *Agri-Kalikasan* Program. It is a science based sustainable agricultural and rural development program that promotes safe and judicious use and proper mixtures of oil-based chemical fertilizers and recycled composted home and farm wastes with other forms and natural sources of soil ameliorants and organic fertilizers.

The *Small Water Impounding Project* (SWIP) was commended for the success in mitigating the effects of El Niño phenomenon in 1998. A field review of SWIP sites will show that the overall socio-economic conditions of the area improved tremendously and provided basis for a real Rural Development.

The overall success in the improvement and sustained soil productivity is made possible by the development of **Rapid Soil Test (RST)** Kit. The RST is a simple and practical tool in diagnosing soil fertility right on the field particularly micronutrients, which be done by the farmers and technicians themselves.

The **Soil and Water Area Coordinators** (SWACs) is a network of technical people working as conduit in the country. Staff assigned in the regions take care of soil and



water conservation related matters. One of the major contributions of SWAC is the coordination and completion of all SAFDZ maps as mandated by AFMA (known as RA 8435). Added value is the database of the land from unnecessary land use conversion and location of areas for public investment for agricultural development. They also contributed in the implementation of the Comprehensive Land Use Program (CLUP) in coordination with the Local Government Units.

The technical capability of BSWM is reflected in its research collaboration with local and international institutions including the --- Bureau of Agricultural Research (BAR); Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD); Australian Centre for International Agricultural Research (ACIAR); Australian Soil and Plant Analysis Council, Inc. (ASPAC); Food and Agriculture Organization (FAO); International Water Management Institute (IWMI); International Atomic Energy Agency (IAEA); Japan International Cooperation Agency (JICA) and ASEAN-Japan.

influence total non-solid pore space as well as pore size thereby imparting water and air relationship.

The summary of both land and soil characteristics serves as guide to soil classification that can assist in the land evaluation and management.

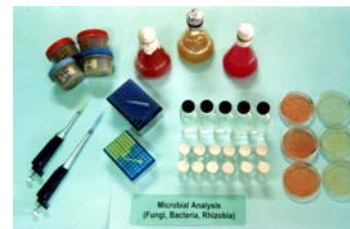
### *Biological Production*

Legume inoculants increase grain legume yields through biological nitrogen fixation. They reduce the need for the application of N fertilizers and increase the grain yield and quality of crops.

The BSWM is mandated to produce and conduct quality tests on various legume inoculants in order to help farmers increase their production.



In congruent to the increasing awareness on biotechnology, production of *Trichoderma harzianum*, compost fungus activator (CFA), for rapid composting was established. Compared with the traditional method of composting which takes about three months, the use of the CFA accelerates the process in just three to four weeks.



### *Soil Test Kit*



The use of the STK will bring soil testing services right in the farm. Before the STK was introduced in the field, farmers have to bring their soil samples to a soil

now make it possible to assess the fertility status of soils, including problem soils like salt-affected soils.

Another commodity that is important in farming is water for irrigation. There are many criteria in assessing water quality depending on the purpose for which it will be used. It is the amount and types of salts present that will determine the suitability of water for its intended use. All natural waters contain dissolved mineral substances collectively known as salts which can have detrimental effects on plants if present in large quantities. For irrigation waters, the usual criteria include salinity, sodicity (sodium content) and element toxicities.

### *Soil Physical Analysis*



The analysis for physical properties of soil has been classically known as a tool in the construction industry. However, through years of intensive research on its application in agriculture, it has become important in

agricultural land management.

In BSWM, soil physical analysis is geared towards optimum agricultural production by focusing on its necessity to crop production. Soil samples from the field are analyzed according to texture, structure, permeability, bulk density and water retention. From laboratory data, the distinct properties of each soil class are known. These are fundamental to fertilizer application, ease of cultivation, irrigation and construction of earth dams.

For instance, physical properties such as texture and structure have profound effects on plant growth and on all kinds of soil manipulations and use. These effects in turn

## The Technical Divisions

### **SOIL CONSERVATION AND MANAGEMENT**

Soil erosion is the most serious threat to agricultural sustainability in the uplands. As much as 200 m<sup>3</sup> of soil per year could lose through erosion when sloping lands are cultivated without the appropriate conservation measures.



This is significant considering that about 7,000,000 hectares of the country's agricultural lands are situated along sloping areas. Furthermore about 25% of the Philippine population reside and do farming on sloping areas.



The BSWM is vigorously advocating and implementing conservation farming to improve and sustain the productivity of sloping areas. It recommends

different soil conservation technologies/ measures that will enhance and maintain productivity based on land characteristics and farmer preferences. Regular training is conducted to assist farmers in the preparation and implementation of farm plans.

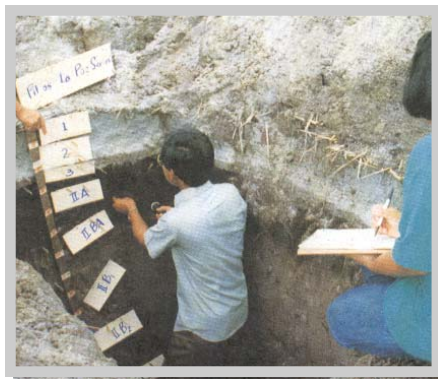
To enhance the adoption of conservation farming technologies, the BSWM established technology demonstration farms in strategic locations in the country and are being managed by the farmers.

## International Cooperation and Network

One of the major partners of the BSWM in the development of soil and water technologies to improve and sustain agricultural productivity is the Government of Japan through the Japan International Cooperation Agency (JICA). Now on its 14<sup>th</sup> year, the project entitled Environmental Productivity and Management of Marginal Soils has benefited the farmers. Techno-demo plots are being showcased at the National Soil and Water Resources Research Centers in Bulacan, Tanay and Bukidnon.

## SOIL SURVEY

The Soil Survey Division generates soil database through morphological examination and description, physical and chemical analyses of soils, to correlate for the proper interpretation and prediction of suitability for various land uses. The outputs are soil report and maps. The soil map is a useful guide in agricultural development and government policymaking. Likewise, it is significant in infrastructure planning and development, soil fertility management, soil and water conservation management, soil research and related disciplines.

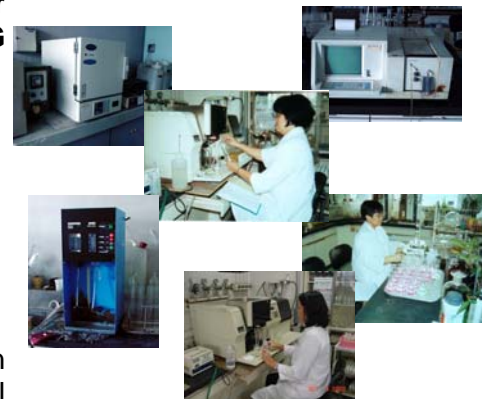


- A. Short-Term Projects  
Detailed/ Semi-detailed Soil Survey - Strategic Agriculture and Fishery Development Zones (SAFDZ) – Comprehensive Land Use Plan Integration (CLUP) -  
A detailed/ semi-detailed soil survey (to be completed within

farmers, it will not be long when the vision of sustainable agriculture in farmlands all over the Philippines shall become a reality.

## **Your Partner to Better F A R M I N G ENTERPRISE:**

## **THE LABORATORY SERVICES DIVISION**



### **The Partnership:**

Soil analysis has been a valuable educational tool for agricultural production. It has served as the focal point for improved fertilization as well as adoption of many other production practices by farmers.

The Laboratory Services Division used to stress the importance of sufficiently broad support to farming communities by conducting information dissemination and trainings/seminars to farmers and technicians regarding the importance of the services offered.

### *Soil and Water Chemical Analysis*

Many farmers cultivate their farms without ever testing their soil. They are fortunate if their soil is not deficient or toxic in nutrients, neither too acid nor too alkaline. If their crops do not seem to be growing well, a soil test is the best starting point for putting things right and keen growers have their soil tested routinely each year. Professional soil testing is the most accurate for macro and micronutrients and this is conducted in a soils laboratory like the Bureau of Soils and Water Management. Recent developments in soil analysis



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- d. Also in collaboration with DTI-BPS, the evaluation of laboratory for licensing and accreditation.

### 5. Other Regular Activities:

The Division also conducts chemical, physical, microbiological and mineralogical analyses of soil samples submitted by farmers and other interested parties. It is also capable of analyzing water samples for chemical and microbiological characteristics.

The Division likewise is giving technical assistance to farmers, students, NGOs, and other clientele.

To achieve relevance of work, the Research Division also conducts in-house review and planning workshop to evaluate and monitor R & D activities and to identify and set research and development priorities. Trainings, seminars and conferences are likewise conducted to transfer matured technologies to farmers. A training on the production of mushroom spawn for farmer leaders in Regions 3 and 4 has just been concluded.

To strengthen its research capability, the Research Division has made modest investments for manpower development through participation of promising technical personnel in training courses, workshops and conferences locally and abroad. This enhances the technical capability of personnel to conduct research on soil and water in various disciplines like soil biology, soil chemistry, soil fertility, soil physics and mineralogy and water use efficiency.

Indeed, the **SOIL & WATER RESOURCES RESEARCH DIVISION** has evolved into one of the most dynamic divisions of the Bureau of Soils & Water Management. With its research programs geared towards the development and generation of technologies for the

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6 months) using the scale 1:50,000; 1:25,000; 1:10,000 or 1:5,000. The project is conducted upon the request of barangays, town/ city (LGUs) for micro-scale development planning. Thematic maps including slope, land use, suitability for specific use/crop, capability, flooding erosion, elevation and fertility map are likewise reproduced.

Government Projects/ Private Farms – The Division provides special soil investigation at 1:50,000 and 1:10,000 or larger scales for planning and development purposes i.e. agricultural, fishery, pasture development, infrastructures and the like. The Soil Survey develops soil maps that may include suitability, slope, erosion, flooding, fertility, fertilizer/ lime recommendation accompanied by soil investigation report. The Division provides soil investigation, soil characterization, sampling for physical, chemical or mineralogical determination on lands affected by pollution and related problems.

#### B. Long-Term Projects

The Division is responsible in the updating of farm level/ barangay, municipal, provincial/ regional and national soil maps (at various scales 1:5,000 1:10,000 1:25,000 1:50,000 1:250,000 1:1,000,000) as references of planners, investors, researchers and developers.

## **AGRICULTURAL LAND MANAGEMENT AND EVALUATION**

Agricultural Land Resources Inventory and Evaluation  
Agricultural land resources inventory and evaluation help decision makers determine the quality of land for agricultural uses and assess sites for agricultural development potential. This facilitates identification and protection of prime agricultural lands and assists in the formulation of management and protection guidelines. Evaluation rate lands according to their suitability to



value-added components as additional incentives to farmers. Thus, the Research Division has introduced the **Biogas, Liquid Fertilizer, and Mushroom Production** as value-added approach to the implementation of the BFS technology. These enabled farmers not only to utilize farm wastes and recycle nutrients, but also to increase their income. To date, 16 biogas digesters were installed in selected provinces throughout the country and mushroom spawns for *Volvariella* (straw mushroom) and *Pleurotus* (oyster mushroom) were produced and distributed to farmers. Technical staffs are also training farmers on the production of mushroom spawn and on the culture of different species of mushrooms so that farmers could produce mushrooms right in their backyard.

The success of the BFS captured the interest of various groups at the national level which paved the way in the recognition of the Bureau of Soils and Water Management (BSWM) by the Civil Service Commission as a **PAGASA Awardee for Outstanding Group Performance Team** in 2002.

**2. The Environmental Productivity Management of Marginal Soils in the Philippines (EPMMA).** The Division is spearheading the implementation of studies on the management of marginal soils, particularly on the Soil Fertility and Fertilizer Component of the Technical Cooperation Project with JICA. The research activities of the Division are centered in three research stations and techno-demo sites located in Tanay, Bulacan and in Bukidnon. To date, five major researches on soil fertility improvement are being conducted simultaneously in the Research Centers. Technologies developed, improved or modified are being demonstrated in the techno-demo sites.

**3. Research Linkages with National and International Institutions.** The Research Division is

### GIS and Remote Sensing Facilities

The state-of-the-art Geographic Information System and Remote Sensing facilities supported by 15 years of technical cooperation with the Japan International Cooperation Agency (JICA). This enabled the Division to pioneer the development of agricultural information system, computer-assisted spatial data analysis, geostatistics and continue with the development of spatial database for policy inputs, research and other non-agricultural applications.

## CARTOGRAPHIC OPERATIONS DIVISION

The Cartographic Operations Division attained a significant increase in the distribution and sales of soil-based thematic maps, recognizing the importance of maps in the planning process and various studies.

The Local Government Units' requirement for maps are centered on comprehensive land use plans and resources inventory while students involved in planning and designs demand for soil maps and maps with related topographic information. Thematic maps are being sold from P 25.00 to P 75.00 per map sheet. On the other hand, a complete set of Atlas for each region can be obtained for P 9,000.00.



Meanwhile, the Division ventured in the preparation and development of a more sophisticated three-dimensional (3D) relief models to showcase resources inventory by the Local Government Units. The 3D models are relatively light, stable and true to scale. Even land use and vegetation and *planimetric* details are prepared and depicted as close as possible to its pictorial and color definition. The Model is relatively light

and can be mounted or framed on a plane and stable surface. The model can likewise be glass-encased to ensure longevity.

The completed relief models included that of the Northern Mindanao Integrated Agriculture Research Center (NOMIARC); San Mariano, Isabelita; Amadeo, Cavite; BSWM Research Centers in San Ildefonso, Bulacan; Tanay, Rizal; Dalwangan, Bukodnon; Mt. Pinatubo-affected area on a 50km. Radius; several water impounding projects; Boac, Marinduque; Tupi Research Station (South Cotabato); Calabanga, Camarines Sur; Parang, Maguindanao; San Isidro, Oriental and other municipalities and regions.

Requests for the preparation of relief models can be coursed through the Office of the Director, Bureau of Soils and Water Management.

## **WATER RESOURCES MANAGEMENT DIVISION**

### **Rainwater Harvesting Technology** **SMALL WATER IMPOUNDING PROJECT (SWIP)**

As early as mid 1950s, small water impounding project (SWIP) has gained prominence among farmers, particularly in the uplands. Known during those days as farm pond,



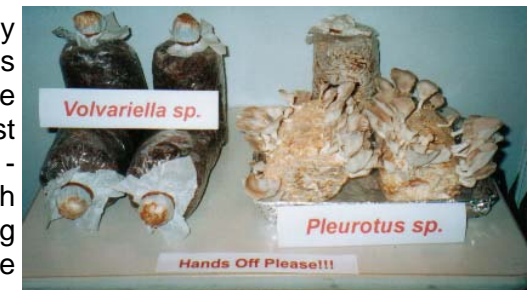
SWIP became one of the high impact projects of the Bureau of Soils and Water Management. SWIP is an earth structure constructed across a narrow depression or valley to hold water and develop a reservoir that collect and store rainfall and run-off for immediate or future use. It is primarily

designed for soil and water conservation and flood

Fertilization Technology. Conceived by our Director, **Dr. Rogelio N. Concepcion**, this project is the BSWM's primary intervention to the stagnating rice yield in the country. The Presidential Proclamation 1071 issued last August 27, 1997 by then President Fidel V. Ramos has mandated the BSWM to formulate and implement the project. This project prescribes location-specific fertilizer recommendations for rice, corn and high-value crops making use of the appropriate combination of organic and inorganic fertilizers to increase crop yield and rehabilitate the soil. There are seven fertilizer groups identified and their respective formulations are established in several on-farm demonstration trials throughout the country. With the BFS technology, the farmers obtained higher net income because of increased production. In majority of the techno-demo sites, the organic matter content of the soil has been maintained when compared with their levels before the introduction of the BFS technology.

The ultimate objective in improving the quality of life of the farmers was also achieved through the BFS. The BFS not only served as a research project but more so as a development project. Through the BFS, the farmers were taught to organize themselves into cooperatives. The farmers realized that as an organized group they could contribute to the rural development of the community.

The strong advocacy of the government on the use of environment-friendly technologies gave rise to the renewed interest on organic-farming, but with the changing emphasis on the





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cavans per year. Aside from irrigation, the reservoir is being used for inland fish production and as source of water for a fish hatchery.

A written testimony from Talugtog SWIP Irrigators Association states “*SWIP has brought major development in their area. It developed portions of rainfed areas into more productive irrigated areas such that two cropping of rice is now possible*”. As of December 2003, a total of 318 SWIPs has been constructed nationwide, providing supplemental irrigation to about 18,159 farmers and benefiting about 13,704 farmers.

## **The SOIL AND WATER RESOURCES RESEARCH DIVISION**

### ***Developing technologies for the FILIPINO farmers***

Agriculture is mainly anchored on the soil and water resources of the country. Effective management of these resources is one of the major concerns of the Bureau of Soils and Water Management. One of its mandates is the of conduct research on different aspects of soil and water utilization, management and conservation through its **SOIL AND WATER RESOURCES RESEARCH DIVISION**.

In close adherence with the R & D thrust of the Department of Agriculture, the SWRRD is focusing its research activities towards the development and transfer of economically-viable and environment-friendly agricultural technologies which have the potential in improving farm productivity and increasing farmers’ income. Some of the priority programs/projects being conducted by the division are the following:

- 1. The Balanced Fertilization Strategy (BFS) Project.** The Division is the lead implementor in the nationwide technology demonstration of the Balanced

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mitigation. The conserved water in the reservoir has a value-added to agriculture being a source of supplemental irrigation, water for livestock and as a facility for inland fish and presently shrimp production. Water in the reservoir can also be used for domestic purposes. Hence, it can be considered as the only infrastructure of the Department of Agriculture (DA) that supports rural development likewise, protects the environment.

SWIP has significant effects in the rural communities in terms of its visible environmental and socio-economic impacts. These are well-reflected by the transformation of the formerly barren and dry rainfed areas into green and eye-refreshing landscapes and by the sudden increase in annual farm production and farm income. As the farmers attained two or even three cropping, local food security is also ensured and farmers’ standard of living is improved.



The project further enhances environmental protection and management through agro-forestry, protection forest establishment, and other soil conservation measures being implemented in the watershed.

In the project implementation, it strengthens partnership among national agencies, local government units, farmers group and promotes closer relationships among various stakeholders.

The importance of SWIP was highly appreciated by local executives and farmer leaders. Hon. Congressman Amatong (former governor of Compostela Valley) once quoted that “*the construction of SWIP increased farm productivity and improved economic condition in their area*”. The existing project can now irrigate 200 ha of farmlands cropped twice a year with an average yield of 80-100