VOLUME 2, NO. 4, 2022 | ISSN 2799-1105

POLICY BRIEF

A publication of the Policy Action Group (PAG) of the Department of Science and Technology-
Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD)

Advocating the Adoption of Guidelines for Science-based Watershed Approach to Integrated Area Land Use Planning

Land use, a major driver of change in natural and human systems, impacts the soil, water, biodiversity, and security of lowland communities over time. Unregulated use and change in land use result in forest fragmentation, soil erosion, river siltation, biodiversity loss, lakes and marine ecosystems degradation, and agricultural productivity decline. In the absence of regulatory mechanisms to promote integrated land use planning and development, the increasing demand for land needed for agricultural and urban development is likely to exacerbate adverse consequences of land use and land use change.

In 2014, the revised "Housing and Land Use Regulatory Board (HLURB) Guidebook for Comprehensive Land Use Plan (CLUP)" was released. The guidebook aspires to facilitate the integration of local land use and development plans through the use of ridge to reef/watershed ecosystem management (R2R/WEM) approach. Despite production of the guidebook, barriers that limit the robust implementation of science-based R2R/WEM approach to comprehensive land use planning remain to be resolved. Among multiple constraints to R2R/WEM-based land use planning in the Philippines, inadequacy of enabling conditions for the robust implementation of science-based integrated approaches to land use planning is foremost. As a result, local land use plans and development plans are more often than not inadequately integrated across local government units (LGUs) and not vertically integrated with provincial and regional plans.

The need to strengthen horizontal integration of local land use plans and national government agency (NGA) sectoral plans across LGUs and vertical integration of local land use and development plans with provincial, regional, and national development plans is now more pressing than before. Balancing the pursuit of economic development goals and environmental protection has become more complicated and challenging amid growing natural and human-induced stressors. As population grows, the demand to intensify economic activities increases, along with pressures on the sustainability of ecosystems and natural resources, and the heightened risks to human welfare and security. This is being aggravated by the unabated changes in climate variability and extreme events. There is now an increasing number of people who are at risk caused by unregulated occupation in hazard-prone areas due to uneven access to disaster-safe areas.

Per capita crop production areas are shrinking as the demand for food increases due to population growth. Urban development and agricultural expansion are slowly encroaching into the remaining forestlands degrading the quality of natural habitats and their ability to support a flourishing diverse community of plants and animals. Available clean water resources such as the Umiray Watershed in General Nakar, Quezon Province (Fig. 1) are decreasing while land productivity is declining due to prevalence of land use practices in areas that are unsuitable for the purpose.

Central to resolving the foregoing conundrum is the need to implement science-based integrated land use and development planning process that harmonizes the competing multiple economic development and environmental protection targets. The R2R/WEM approach in land use planning prescribed in the revised HLURB Guidebook for CLUP is an excellent legal foundation to promote a balance between economic development and environmental protection. It also integrates development goals across LGUs and with the local, regional, and national development agenda.

To realize the full potential benefits from the R2R/WEM approach to CLUP, creation of a sufficient enabling environment is in order. This includes enhancement of the knowledge, appreciation, and expertise of LGU and NGA planners on the robust implementation of the R2R/WEM-based land use planning. There is also a need for more detailed supplementary instructions or guidelines on how the R2R/WEM approach to land use planning may be operationalized. It is in this regard that the guidelines for Watershed-based Integrated Area Land Use Planning (WIALUP) may be considered to supplement the existing HLURB Guidebook for CLUP. The guidelines were developed through the Department of Science and Technology-Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD)-funded research and development (R&D) project, "Policy Study and Development to Promote the Resiliency of Philippine Watersheds," which assessed key policies related to watershed management. This policy brief highlights the key findings of the abovementioned policy study.

Fig. 1. Umiray Watershed in General Nakar, Quezon Province. (WIALUP Project Team 2019)

PROJECT BRIEF

Cognizant of the threats faced by the country's natural resources, DOST-PCAARRD supported the study implemented by the University of the Philippines Los Baños (UPLB) under the leadership of Academician Rex Victor O. Cruz. The study assessed the major policy issues and concerns that are crucial to the resilience and sustainability of watersheds in the country (Fig. 2).

The study noted that despite existence of laws and regulations (Table 1) requiring integrated land use planning, the actual integration of land use and development plans across LGUs and NGAs and from top to bottom remains limited. To promote greater integration of sectoral development plans, this policy brief proposes the robust implementation of R2R/WEM approach to CLUP using WIALUP guidelines as detailed reference on the associated step-by-step planning process.

KEY ISSUES AND OUTCOMES OF SECTORAL LAND USE PLANNING AND DEVELOPMENT

The limited horizontal and vertical integration of local land use plans in the country is associated with various issues such as land use conflicts and unregulated land conversion, degradation of forests and biodiversity, landscape ecosystems degradation, and increasing risks and vulnerabilities all detrimental to human security and welfare.

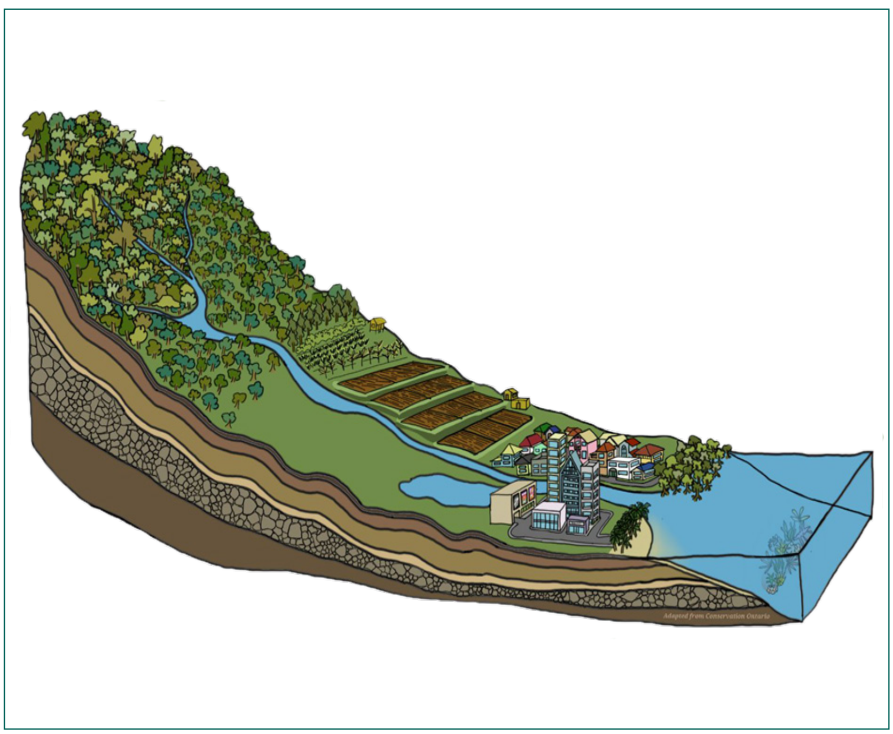

Fig. 2. Typical R2R/watershed landscape unit. (adapted from Conservation Ontario n.d.)

Land Use Conflicts and Land Conversion

Land use change is inevitable with the growing demand of an expanding population for space for agriculture, urbanization, and other activities. The drivers of deforestation in the Philippines could very well be the same drivers of land cover change in the country (Carandang et al. 2013). These drivers include policy and governance constraints, poverty, and absence of a robust integrated framework for land use planning and allocation in both local and national levels. Without a unifying framework and planning, allocation and use of land resources are largely influenced by the sectoral priorities and preferences of LGU and NGA with mandates and authority to dispose, allocate, and reclassify lands within its jurisdiction that often result in uncoordinated, unsuitable, and unsustainable uses and development.

For this reason, there is a proliferation of land uses that do not conform with the legal land classification and are beyond the inherent capability of the land to sustainably support specific uses. For example, in National Integrated Protected Area System (NIPAS) areas, data from the DENR-Biodiversity Management Bureau (BMB) shows that there are more than 32,000 hectares (ha) of built-up, annual, and perennial croplands that are not allowed by law.

Table 1. List of pertinent laws reviewed and examined.

Law Number	Title
HLURB Resolution No. 908 Series of 2013	Approving the 2013 Enhanced Comprehensive Land Use Plan Guidebook Volume 1
HLURB Resolution No. 918 Series of 2014	Approving the Enhanced CLUP Guidebook Volume 2, Sectoral Studies and Tools for Analysis
HLURB Resolution No. 919 Series of 2014	Approving the Enhanced CLUP Guidebook Volume 3, The Integrated Model Zoning Ordinance
Presidential Decree No. 705 Series of 1975	Revised Forestry Code of the Philippines
Proclamation No. 2146 Series of 1981	Proclaiming Certain Areas and Types of Projects as Environmentally Critical and Within the Scope of the Environmental Impact Statement System Established under Presidential Decree No. 1586
Executive Order (EO) No. 192 Series of 1987	Reorganization Act of the Department of Environment and Natural Resources
Republic Act No. 7586 of 1992	National Integrated Protected Areas System Act of 1992
Republic Act No. 7942 of 1995	Philippine Mining Act of 1995
Republic Act No. 8041 of 1995	Water Crisis Act
Department of Environment and Natural Resources (DENR) Administrative Order 2013-08	Adopting an Integrated Water Quality Management Framework to Provide Cohesive Direction in Integrating All Existing Frameworks on Water Quality Pollutions and Related Initiative
Republic Act 9729 of 2009	Climate Change Act of 2009
DENR Memorandum Circular 2008-04	The 2009 Upland Development Program (Reforestation and Agroforestry)
DENR Administrative Order 2005-23	Adoption and Implementation of Collaborative Approach to Watershed Management
EO No. 318 Series of 2004	Promoting Sustainable Forest Management in the Philippines
Republic Act No. 7160 of 1991	Local Government Code of 1991
EO No. 79 Series of 2012	Institutionalizing and Implementing Reforms in the Philippine Mining Sector, Providing Policies and Guidelines to Ensure Environmental Protection and Responsible Mining in the Utilization of Mineral Resources
EO No. 72 Series of 1993	Providing for the Preparation and Implementation of the Comprehensive Land Use Plans of Local Government Units Pursuant to the Local Government Code of 1991 and Other Pertinent Laws
DENR Administrative Order 2017-02	Guidelines on Implementation of Sustainable Integrated Area Development (SIAD) Strategy

Between 1988 and 2010, more than 1.5 million (M) ha of cultivated lands became degraded and marginalized, and built-up areas used for residential, commercial, and industrial purposes. This is based on the extracted data in 2015 by the National Mapping and Resource Information Authority (NAMRIA) as presented in the abovementioned policy study.

Degradation of Forests and Biodiversity

Recent estimates place the forest cover in the Philippines at roughly 23 percent (%) in 2020 (FAO GFRA 2020). This is far from the almost 70% forest cover at the turn of the 20th century (ESSC 2017). Separate studies of Carandang (2008) and Carandang et al. (2013) reported that illegal logging, agricultural expansion, and infrastructure development are the leading drivers of forest cover loss and degradation in the Philippines. According to the National Academy of Science and Technology (NAST) in 2021, forest cover has increased between 2010 and 2015. Despite this, some watersheds and river basins continue to lose forest cover during the same period. Further, the loss of forest cover was noted to be directly related to the increase in cultivated areas.

These observations in the country are consistent with the global trend that agriculture is the most influential driver of forest cover loss (d'Annunzio et al. 2015; FAO and JRC 2012). It was also reported that 70–95% of forest cover lost in the tropics were converted to agriculture (Holmgren 2012).

The expansion of agriculture and the associated settlements to natural landscapes (i.e., forests, grasslands, and savannas) are inevitable as population grows, and additional areas are demanded for agricultural production. The largest expansion is projected for the increase in rice and other crop production areas that will be degraded through soil erosion due to the lack of proper soil and water management. Growth in the expansion of oil palm and bioenergy plantation is likely to become a more concerning threat to remaining forests.

The United Nations Environment Programme (UNEP) estimates that under business-as-usual scenarios, the rate of global expansion of cropland will breach the threshold for safe operating limit. In a landscape unit such as watershed, or an R2R landscape such as the main river of Kanan Watershed in General Nakar, Quezon Province (Fig. 3), there is a safe limit to the extent of land that can be used for agricultural development, urbanization and other development activities, beyond which, irreversible damage to ecosystems including biodiversity is inevitable.

Encroachment of agriculture into forestlands will likely be difficult to regulate in the absence of a comprehensive and integrated framework for delimiting areas that can be used for and those that are off limits to agriculture and other purposes with minimal environmental impacts. Hence, the proposition to enhance the robustness of the implementation of R2R/WEM approach to comprehensive land use and development planning through the adoption of WIALUP guidelines, as a detailed reference guide.

Interlinked Degradation of Ecosystems from Ridge to Reef

Natural resources degradation (i.e., soil, water, biodiversity, and ecosystem services) are pervasive from ridge to coastal and marine areas. It is common to see degraded and excessively silted mangroves and corals that are associated with streamflow loaded with sediments and pollutants coming from agricultural areas, poorly constructed and maintained roads, overgrazed rangelands, deforested mountainous areas, and industrial and household wastes. In addition, most major rivers are already polluted because of wastewater coming from residential areas.

The persistence of the landscape-wide degradation in many watersheds had long been attributed to the fragmentation of mandates and responsibilities to manage, develop, and protect watersheds. More than 30 government agencies are operating under varying mandates related to the management and development of watersheds in the country (Rola et al. 2015). Due to the absence of appropriate mechanisms to facilitate the harmonization and coordination of the plans and programs of all concerned agencies, efforts to address degradation across landscapes are at best asynchronous and at worst contradictory, resulting in inefficiencies in the use of limited financial resources.

Fig. 3. Main river of Kanan Watershed in General Nakar, Quezon Province. (WIALUP Project Team 2019)

Increasing Risks and Vulnerabilities to Climate Change and Other Natural Hazards

Climate change and other natural disasters are becoming more intense and detrimental to the socioeconomic development and security of human settlements and livelihoods. Typhoons, floods, and landslides are the top three most frequent and most damaging disasters in the Philippines, which are projected to intensify in the future. Damages to agricultural crops and infrastructure will continue to rise and significantly hamper the growth of the sector. Between 2010 and 2019, the total damages in agriculture amounted to P290 billion (B) or almost P29 B annually (PSA 2023). The risks of various climate-related disasters are interconnected spatially and therefore should be dealt with using the R2R/WEM approach in developing comprehensive Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) measures to cope with the interlinked risks and vulnerabilities from ridge to coastal and marine areas.

ISSUES AND CONCERNS ON THE ADOPTION AND IMPLEMENTATION OF WIALUP

While there are several policies and programs promoting WIALUP (i.e., R2R/WEM approach to CLUP), application of the approach is largely limited. Various factors were observed to impede implementation specifically at the LGU level.

Need for Detailed Supplemental Guidelines for Robust Implementation of R2R/WEM Approach to CLUP

The revised HLURB guidelines for the preparation of CLUP can be further strengthened by providing more detailed guides on how R2R/WEM approach is operationalized in the preparation and updating of CLUP, including the use of analytical tools and procedures to assess the impacts and trade-offs of land uses on the ecosystems within the R2R landscape.

Limited Culture of Institutional Mechanisms for LGUs and NGAs to Coordinate and Harmonize their Plans and Programs

Local, medium-, and long-term development goals should be sufficiently coordinated and harmonized. There is a need to use appropriate landscape units as the basic unit of planning that can provide the physical framework within which local, provincial, regional, and national land use and development plans may be facilitated.

This may result in a strengthened link of development goals at various scales and levels where the local development goals are intimately harmonized with and factored into the provincial, regional, and national development goals. This may lead to greater appreciation and voluntary support of the local stakeholders in the pursuit of provincial, regional, and national development goals that bear the imprints of the local sentiments, preferences, and aspirations.

Inadequate Knowledge and Understanding about WIALUP

The observed limited implementation of the R2R/WEM approach in the preparation and updating of CLUP, and limited engagement of LGU officials in the preparation of CLUP using the revised HLURB guidelines could mean inadequate appreciation and understanding of the values and importance of the approach.

Too Many Prescribed Plans for LGUs to Prepare and Implement

The LGUs are overburdened with the preparation, development, and implementation of more than 30 prescribed sectoral plans. These plans are prepared using parallel guidelines that make harmonization and coordination of these plans challenging, if not impossible.

Inadequate Expert Human Resources

In most LGUs, planning is commonly left to one or two technical staff, usually engineers who are multitasking and straddling two or more offices. This limitation becomes more prominent in light of the commonly observed extended period of time required for planning.

Absence of Long-term and Up-to-date Empirical Datasets, Maps, and Other Information

It was observed that most LGUs recognize the constraints associated with the limited availability and access to fresh and reliable data that are needed for planning, (e.g., maps and climatic data). Without these datasets, making critical choices and decisions in land use planning is prone to the limitations of intuitive approach and inferences from information and experiences gathered from other areas.

POLICY IMPLICATIONS

Key Features and Applications of WIALUP Framework

Below are the features of WIALUP guidelines that support for its use as a supplemental reference for the robust implementation of R2R/WEM approach in the preparation and updating of CLUP to facilitate its integration into the provincial, regional, and national plans:

- A multidisciplinary approach to land use planning and development that integrates the physical, biological, social, economic, and environmental considerations. It requires active engagement of various NGAs, civil society, local communities, private sector, academe, and other stakeholders;
- A science-based framework that requires fresh datasets for the assessment of the past, current, and emerging issues and concerns (i.e., problems, opportunities, constraints, and threats) that will set the direction and priorities of land use planning and development, and for the analysis of trade-offs between alternative land uses;
- A framework that recognizes primacy of promoting ecological balance and environmental protection over maximizing economic development potentials of land and other resources;
- A framework for determining the best combination of land uses to simultaneously achieve socioeconomic development goals and ecological and environmental protection goals. It is a framework for determining how much land is needed for protection (i.e., conservation of biodiversity and ecosystem services, soil and water conservation, carbon sequestration, and disaster risk reduction), and how much land is needed for production (i.e., agriculture, forestry, industry and commerce, urban areas, mining, and tourism);
- A framework for harmonizing protection and production land uses to minimize overlaps, competition, and conflicts, and to promote synergy and complementation;
- A framework for promoting coordination and collaboration among government agencies, and for achieving synergy of its plans, programs, and policies from national to local level;
- A framework that can guide national government agencies in a bottom-up process of identifying the projects and development efforts that are most relevant to meet the priority socioeconomic and environmental protection needs at the local government level;
- A framework that is helpful in keeping the use of land for various purposes within the limits of its carrying capacity to avoid long-term ecological and environmental degradation;
- A long-term and robust integrated framework for the preparation and updating of CLUP, Comprehensive Development Plan (CDP), Forest Land Use Plan (FLUP), Agricultural Development Plan (ADP), Local Climate Change Action Plan (LCCAP), Local Disaster Risk Reduction Management Plan (LDRRMP), and other sectoral development plans of LGUs.

Illustrated below is the connectivity of the watershed planning process and the development and/or updating of CLUP, CDPs, and other LGU plans (Fig. 4);

- A framework for consolidation of the Integrated Coastal Management (ICM) Plan with CLUP. As per the latest guidelines of HLURB, CLUP should integrate ICM, where LGUs have the mandate to manage their own municipal waters; and

- A framework that facilitates integration and convergence of CLUP with watershed management and ICM plans.

Figure 4 shows the schematic diagram on how the watershed management plans, ICM plans, and CLUP converge, and can be used as the basis for the development of CDP.

GUIDELINES ON WIALUP FRAMEWORK

The WIALUP framework consists of five components, namely: (1) watershed situational analysis; (2) identification of issues and concerns; (3) setting of watershed goals and targets; (4) delineation of watershed zones (based on land capability) and land use planning; and (5) development of watershed-based projects.

Watershed Situational Analysis

Watershed situational analysis produces a detailed description of the watershed unit that serves as the concrete foundation of problem analysis, problem solving, vision, mission, goal and target setting, and land use planning and project formulation. The outputs of the situational analysis include comprehensive biophysical and socioeconomic profiles of the watershed, land capability map, and compendium of all datasets, maps, literatures reviewed, compilation of related policies, and ongoing and planned programs, stakeholder analysis report, sectoral assessment reports, among others.

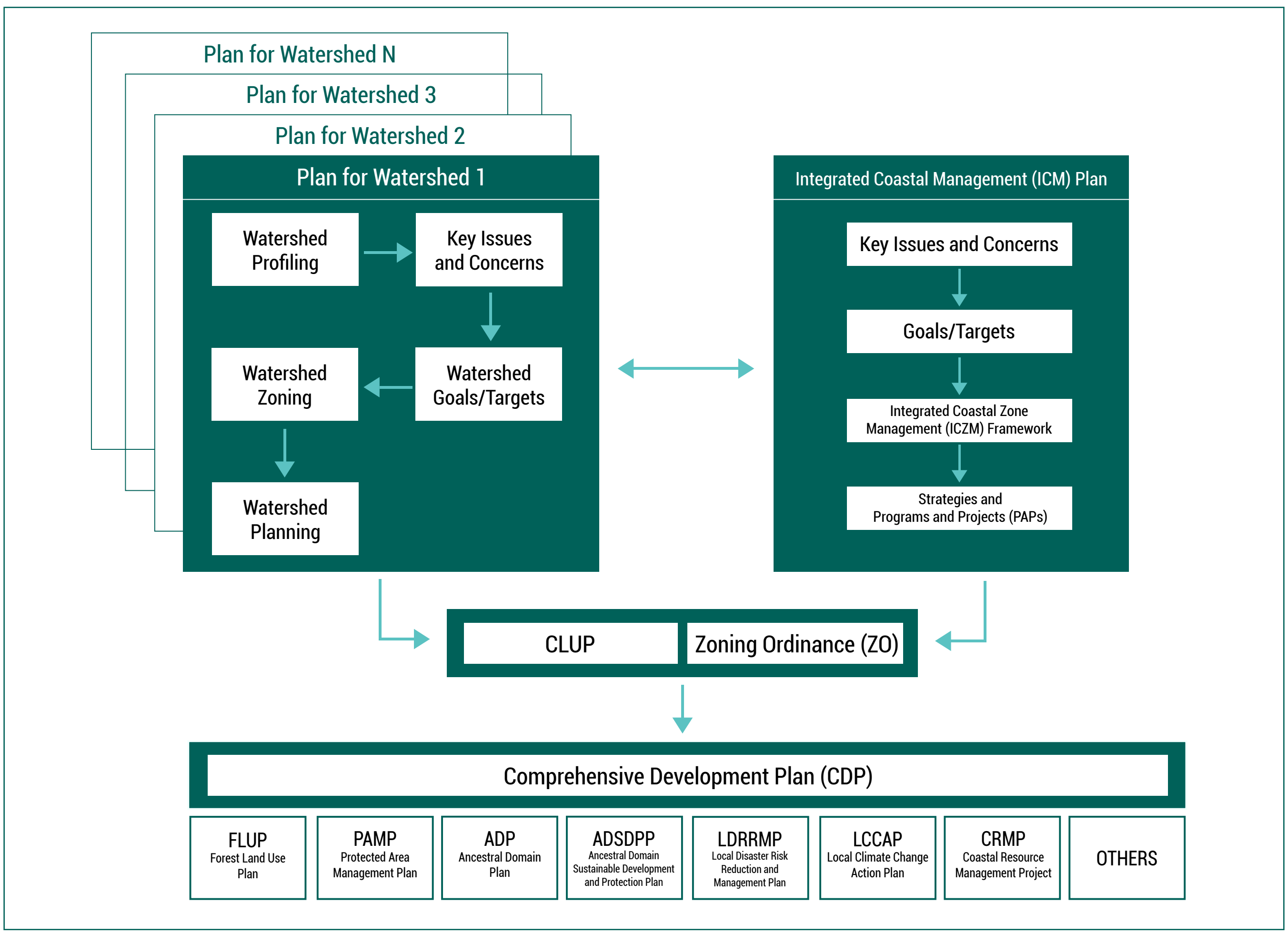

Fig. 4. Proposed framework for WIALUP as basis for the preparation and updating of CLUP, CDP, and other mandated sectoral plans. (Cruz 2019)

In large part, this process engages the active participation of various government agencies and nongovernment organizations, LGUs, local communities, and other stakeholders both as sources of data and information and as active participants in the familiarization process with the watershed features, functions, services, and stressors. It relies on the use of secondary data (Table 2) complemented with primary data gathering in assessing the various biophysical and socioeconomic attributes of the watershed. This may include physiographic and morphometric assessment, climate change studies, hydrological assessment, soil erosion estimation, biodiversity assessment, land capability evaluation, land use and land cover change assessment, stakeholder analysis, sociodemographic analysis, livelihood assessment, resource use pattern analysis, water supply and demand analysis, policy and institutional analysis, and many more.

Identification of Issues and Concerns

The salient issues and concerns, strengths and weaknesses, and opportunities and threats identified within and outside of the landscape are analyzed in this component. The outputs of this component serve as the bases for setting/modifying vision, goals, and targets (ecological/environmental and socioeconomic) that land use planning and design of strategies and programs, projects, and activities (PPAs) will seek to achieve. This is a participatory process involving key stakeholder groups.

Table 2. Secondary datasets for watershed situational analysis and its potential sources.

Agency	Datasets
National Mapping and Resource Information Authority (NAMRIA)	Topographic, morphometric, land use and land cover, aquatic and marine maps, and satellite images
Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)	Climate databases including climate scenarios from various government agencies, academic and research institutions, and other sources
Philippine Institute of Volcanology and Seismology (PHIVOLCS)	Geohazards databases and maps
Philippine Statistics Authority (PSA)	Socioeconomic databases from National Economic and Development Authority (NEDA), Department of Agriculture (DA), DENR, Department of Agrarian Reform (DAR), Department of Public Works and Highways (DPWH), Department of the Interior and Local Government (DILG), and other government agencies
DOST-PCAARRD	All databases, information and technologies generated from all research projects funded by or through government agencies including DA, DENR, and other government agencies

Setting of Watershed Goals and Targets

The goals and targets are defined and set based on preferences and aspirations of LGUs, local communities, NGAs, and other stakeholders informed by the watershed profiles, and issues and concerns identified in previous components. It is essential that this process is inclusive, participatory, and integrative in order to promote ownership of the plan among various stakeholders from all levels.

Delineation of Watershed Zones and Land Allocation

Watershed zoning based on land capability is conducted to generate a physical framework for allocating watershed to various land uses to achieve socioeconomic development goals without compromising environmental and ecological resilience and sustainability.

The zoning of watersheds provides a guide for LGUs in determining the combination of land uses that is most profitable in their respective jurisdiction without undermining the long-term ecological balance and environmental security in the watershed where these are wholly or partly located. This is also useful in assessing what modifications should be made to all existing land uses that are located in areas not suitable for them based on the watershed zoning. It is important to test the ability of the zoning framework to achieve the desired protection and development targets. Likewise, the potential impacts of alternative land use mixes on the quality of natural resources and ecosystem services need to be assessed. This will ensure that the implementation of land uses will promote achievement of socioeconomic targets and protection of the environment and ecosystems (Fig 5).

The commitment of LGUs, NGAs, and other stakeholders to use the final watershed zoning as its common planning reference is necessary to promote synergy and integration, and minimize conflicts and unnecessary overlaps of plans, programs, and activities in a watershed.

Fig. 5. View of the Kaliwa and Kanan Watershed in General Nakar, Quezon Province. (WIALUP Project Team 2019)

Watershed-Based Project Development

Based on the final watershed zones and land allocation, suitable specific projects may be identified and developed. Identified projects are formulated and assessed on their contribution to the achievement of target indicators for each of the ecological protection and socioeconomic development goals agreed upon by the watershed stakeholders, and their feasibility.

Moreover, intensive information, education, and communication (IEC) materials on R2R approach and capacity building of LGU technical staff must be planned and implemented. These efforts should increase LGUs' and stakeholders' appreciation of the benefits of watershed-based approach in planning, and lead towards its adoption and application from local to regional and national levels.

A CALL FOR WATERSHED-BASED INTEGRATED AREA LAND USE PLANNING

The need for greater integration of land use and development of policies, plans, and programs is increasingly gaining attention of major international and local agencies and organizations. This is based on the growing evidences on the link between environmental and ecological degradation with the surge in disaster and health risks in many countries (NAST 2021; Leclere et al. 2020; Secretariat of the Convention on Biological Diversity 2020; Wernecke et al. 2020; UNEP 2017; UNCCD 2017; Sayer et al. 2012). The unabated loss of forest cover and biodiversity in many parts of the Philippines, together with the mounting risks to life and property associated with typhoons, floods, and landslides, compel stronger resolve to promote robust integration in the use and development of forests, land, water, and other natural resources adopting R2R/WEM approach and other holistic and landscape-based approaches. Fragmentation of natural resources management and development plans needs to be addressed to reduce risks to human security and welfare, and reverse ecosystem degradation towards restoration. This will require greater investment in research and technology development to improve our understanding on how ecosystems respond to natural and anthropogenic stressors, and to build sufficient empirical datasets that are needed for robust science-driven policies, plans, and programs. Transformation of mindsets and development of new skills and practices are also essential to the precise application of R2R/WEM approach to integrated land use and development planning across temporal and spatial scales, levels, and sectors. Policy change is imperative to remove barriers to adoption of science-based watershed approach and to set incentives for interagency and inter-LGU collaboration.

REFERENCES

Carandang AP, Bugayong LA, Dolom PC, Garcia LN, Villanueva MMB, Espiritu NO. 2013. Analysis of key drivers of deforestation and forest degradation in the Philippines. Manila, Philippines: Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) GmbH. 110 p.

Carandang AP. 2008. The forestry sector: Costs of environmental damage and net benefits of priority interventions: A contribution to the Philippines Country Environmental Analysis. Manila: World Bank Philippines.

Conservation Ontario. [date unknown]. [cited 2023 Mar 6]. Available from: https://conservationontario.ca/.

Cruz RVO, Fernando ES, Bantayan NC, Castillo ML, Estoque CD, Ata JP. 2013. Scoping study on climate change and biodiversity of protected areas and key ecosystems in Southeast Asia. German Cooperation (Deutsche Zusammenarbeit), GIZ (Deutsche Gesellshaft fur Internationale Zusammenarbeit (GIZ) Gmbh), and ASEAN Center for Biodiversity. 85 p.

d'Annunzio R, Sandker M, Finegold Y, Min Z. 2015. Projecting global forest area towards 2030. *For Ecol Manage* [Internet]. [cited 2021 Jun 20]; 352: 124–133. Available from: https://doi.org/10.1016/j.foreco.2015.03.014.

[EPA] Environment Protection Agency. [Internet]. 2021. What are the trends in land use and their effects on human health and the environment? [cited 2021 Jun 24]. Available from: https://www.epa.gov/report-environment/land-use.

[ESSC] Institute of Environmental Science for Social Change. [Internet]. 2017. Philippine forest cover 2002. [cited 2023 Jan 5]. Available from: https://essc.org.ph/content/view/398/1/.

[FAO and JRC]. Food and Agriculture Organization and Joint Research Centre. 2012. Global forest land-use change 1990–2005. FAO Forestry Paper No. 169. Rome, Italy: Food and Agriculture Organization of the United Nations.

[FAO] Food and Agriculture Organization. [Internet]. 2020. Global forest resources assessment (GFRA). [cited 2020 Jun 20)]. Available from: https://fra-data.fao.org/PHL/fra2020/home/.

Holmgren L. [Internet]. 2012. The global need for food, fibre and fuel. Åke Barklund, General Secretary and Managing Director, KSLA. [cited 2021 Jun 20]. Available from: http://www.ksla.se/wp-content/uploads/2012/06/KSLAT-4-2012- Food-fibre-and-fuel.pdf.

Lech M, Leppert G. 2018. Current issues of the Philippines land use planning and management system. German Institute for Development Evaluation. Bonn: Germany. 4 p.

Leclère D, Obersteiner M, Barrett M, Butchart SHM, Chaudhary A, De Palma A, DeClerck FAJ, Di Marco M, Doelman JC, Dürauer M, et al. 2020. Bending the curve of terrestrial biodiversity needs an integrated strategy. *Nature* [Internet]. [cited 2023 Mar 6]; 585: 551–556. Available from: https://doi.org/10.1038/s41586-020-2705-y

[NAST] National Academy of Science and Technology. [Internet]. 2021. The Philippine Science, Technology, and Innovation Foresight. PAGTANAW 2050. [cited 2021 Nov 19]. Available from: https://.ph/index.php/pagtanaw-2050.

[PSA] Philippine Statistics Authority. [Internet]. 2023. Damages due to natural extreme events and disasters amounted to PhP 463 billion. [cited 2023 Mar 6]. Available from: https://psa.gov.ph/content/damages-due-natural-extreme-events-and-disasters-amounted-php-463-billion.

Rola AC, Pulhin JM, Tabios III GQ, Lizada JC, Dayo MHF. 2015. Challenges of water governance in the Philippines. *Philipp J Sci*. 144 (2): 197–208.

Sayer J, Sunderland T, Ghazoul J, Pfund JL, Sheil D, Meijaard E, Venter M, Boedhihartono AK, Day M, Garcia C, Oosten CV, Buck L. [Internet]. 2013. Ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses. PNAS. [cited 2023 Mar 6]. Available from: https://www.pnas.org/doi/full/10.1073/pnas.1210595110.

Secretariat of the Convention on Biological Diversity. 2020. Global biodiversity outlook 5–Summary for policy makers. Montréal, Quebec: Secretariat of the Convention on Biological Diversity.

[UNCCD] United Nations Convention to Combat Desertification. [Internet]. 2017. Global land outlook. [cited 2023 Mar 6]. Available from: www.unccd.int.

[UNEP] United Nations Environment Programme. [Internet]. 2017. Frontiers 2017 Emerging Issues of Environmental Concern. United Nations Environment Programme, Nairobi. [cited 2023 Mar 6]. Available from: https://wedocs.unep.org/20.500.11822/22255.

Wernecke B, Millar DA, Walters M, Ganswindt A, Dziba L, Wright CY. 2020. Preventing the next pandemic–A 2020 UNEP frontiers series report on zoonotic diseases with reflections for South Africa. *S Afr J Sci* [Internet]. [cited 2023 Mar 6]; 116(7/8). Available from: https://sajs.co.za/article/view/8531.

EDITOR'S NOTE

This policy brief is drawn primarily from the results of the focus group discussions and key informant interviews of key stakeholders of the Integrated National Watershed Research and Development (INWARD) sites (Abakun, Abuan Watershed, Pagsanjan-Lumban Watershed, Quiaoit Watershed, Quinali A Watershed, Bataraza, Maasin Watershed Muleta Watershed, Manupali, Saug Watershed, and Mt. Kitanglad National Range Park), which were implemented as part of the project "Policy Studies and Development to Promote the Resiliency of Philippine Watersheds."

POLICY BRIEF is a quarterly publication of the Policy Action Group (PAG) of DOST-PCAARRD that highlights the Council's stance on policy issues on S&T in agriculture, aquatic, and natural resources.

For more information, please contact:

The Executive Director
DOST-PCAARRD
Los Baños 4030, Laguna, Philippines
Tel. No.: (6349) 554-9670
Fax No.: (6349) 536-0016; 536-7922
E-mail: pcaarrd@pcaarrd.dost.gov.ph
Website: www.pcaarrd.dost.gov.ph

Technical Writers : **Rex Victor O. Cruz**
Ma. Larissa Lelu P. Gata
Nelson Jose Vincent B. Querijero
Aileen V. Lapitan
Eric Paul D. Peralta
Vida Q. Carandang
Dixon T. Gevaña
Marlo D. Mendoza
Noel T. Tolentino
Katherine V. Arquio

Technical Editors : **Mia Barbara D.V. Aranas**
Farah Y. Sevilla
Annette M. Tobias

Editor : **Joel Eneristo A. Joven**

Layout Artist : **Reinier Josef D. Abagat**

Editorial Advisers : **Ernesto O. Brown**
Marita A. Carlos