Preface

Ever since I came to the Soil Survey Division of the Bureau of Soils and Water Management (BSWM) in the early 1990s, I have but only one dream—to consolidate our knowledge and understanding of Philippine soils. I stood in awe before the foremost Filipino pedologists and colleagues who could identify and delineate a soil series by just looking and studying a soil profile during our fieldwork. With literally hundreds of soil series in the Philippines, 375 established soil series in my last count, of which 12 soil series are yet to be given new code numbers, having been left out since the 2009 publication of our *Manual of Map Standards and Symbols for Soil and Water GIS*, how could our experienced soil surveyors immediately recognize the soil series in the field? With further retirement of these eminent and highly experienced soil surveyors, we need to pass on to the next generation their knowledge and understanding of Philippine soils.

Soil is a continuum and at ground level, there is no way to distinguish where one soil mapping unit ends and another begins. As such, soil mappers use more visible indicators like geomorphology, land cover, and soil parent material from which the soil developed and can be either residual (in situ) from the underlying rock below, or transported by water and gravity, and consider other important factors or indicators to delineate one soil mapping unit from the other. The *soil series*, as the lowest category in soil classification, is introduced in order to organize our knowledge of soils. A soil series is named after the place it was first described, and not necessarily limited to one area but could also occur in other areas and across landscapes as well. It is interesting to note that some places in the Philippines are named after people who have made significant contributions to Philipino society and thus, we do have many soil series named also after people.

The Soils of the Philippines presents the original soil series concept or the "genetic key" as defined by the early Filipino pedologists, who during those decades of the 1940s, 1950s, and 1960s, generally had a strong geological background. By soil concept, we refer to a conceptual entity or thought pattern that describes the "central nucleus" or essential characteristics that distinguish one soil series from another soil. This is based mainly on soil morphology as an expression of pedogenesis. A soil series consists of pedons with soil horizons similar in soil color, soil texture, soil structure, other properties, and similar arrangement in the soil profile. We emphasize *arrangement* because it is the presence or location of a specific feature within the profile that makes one soil series different from another, considering variability of many measurable properties even within the same soil series in a given soil mapping unit. For example, soils in former tidal flats characterized by the presence of coralline materials below the control section (150 cm) or the substratum is specific to Obando soil series. If the coralline materials are found within the control section, it will be another soil series—such as Pulupandan series if found in the substratum and consists of pure marine shells. The similarity of arrangement as described or compared with the genetic key defined for the soil series makes the soils being classified to belong to that particular soil series even if it is located in another area.

These basic soil concepts like what is a pedon, what is soil morphology, and what is pedogenesis will be explained in the introductory pages. The soil morphology represents

an important diagnostic criterion for a particular soil profile to be classed under a specific soil series. Those unfamiliar with soils would notice that in distinguishing one soil series from the other, an important criterion is the nature of the substratum. We go down the soil profile because the surface soil can be subjected to changes with time such as thinning out due to erosion, and changes in physical and chemical properties because of human activities and interventions. Soil color (usually at moist condition), texture, and clay downward movement are also important criteria because these properties do not easily change with time.

A look at the unpublished master list of the established soil series of the Philippines (possibly circa mid-1960s) mentioned that this was adopted from the "Key to Soil Series of California" by Storie and Weir (1941) of the University of California. There were nine groupings of the Philippine soil series, based on physiography, the kind of parent material and mode of formation, and the kind of soil profile. The alluvial soils were placed in groups 1–5, group 6 was basically a mix of alluvial and residual soils, and groups 7–9 were residual soils. The underlying substratum, whether unconsolidated (groups 1–4) or consolidated (groups 5–9) was a major differentiating factor. We have maintained these concepts of grouping soils based on the kind and nature of the substratum, incorporating redefinitions for those soil series revisited decades later to facilitate field identification.

The Soils of the Philippines is actually the first published consolidation of the Philippine soil legacy data, the fulfillment of that dream. With over a 100 years of soil survey work, certainly many changes have occurred with the passing of time as we revisited some soil series in the succeeding decades while other soil series remained untouched since initially surveyed and mapped. It is inevitable that we find ourselves faced with two similar soil series almost similar in morphology but different in physiographic position, one located in a higher position than the other. This would be easier to differentiate and recognize in the field. Worst, we find ourselves with soil series of similar geomorphic characteristics such as depositional process, geomorphic position or micro-landscape location, the nature of parent material, and the topographic expression. We have encountered two different soil series in two different islands, the same alluvial plain landscape position, the same soil series concept by having similar substratum of unconsolidated materials, the same stony subsoil characteristics, and the same drainage properties; in fact, exhibiting the same redoximorphic features, specifically orange mottles.

Soil profile description alone would not suffice in this case as we expect variation in morphological properties given a soil series. The *Typical Pedon* is the central concept pedon that readers will find in this book. Surveyors would observe a certain degree of differences from the Typical Pedon during actual field survey. Without anymore the retired Filipino pedologists to assist us to differentiate these similar established soil series, we redefine such two similar soil series that we come across with by introducing the concept of *geomorphic surface*, defined as a landform or group of landforms that represents an episode of landscape development. Traditionally in the study of soils, the concept of geomorphic surface is used to explain why for instance, younger soils like those classified as Entisols, are side-by-side with an old soil like Ultisols in a given landscape. We try to extend this concept to differentiate very similar soil series by recognizing the major geomorphic surface units where they are found. Despite the fact that the senior author is not aware how these geomorphic surface units are named or officially recognized in the geological literature, in which case we improvise the nomenclature to facilitate the identification, the geological history provides a clue about the geological episode of landscape development. Since the soil is weathered parent material, we would have to go to mineralogy as possibly confirmed by the geomorphological nature and age of the soil parent material to be able to differentiate such similar soil series. This is the only way we could move forward to completing the Philippine soil legacy data.

When the initial outputs of this study, Keys to the Soil Series of the Lowland Soils of the Philippines, was presented during the 6th East and Southeast Asia Federation of Soil Science Societies (ESAFS) held in Taipei, Taiwan, November 24–29, 2003, the eminent Dr. Hari Eswaran of USDA commented that such effort would tend to restrict initiatives to establish new soil series. Future surveyors would just depend on the key for soil series classification. On the contrary, the senior author believes that coming up with a systematics of the soil series of the Philippines will enable us to see the "box gaps" in the classification system where soils that do not fit into any of the existing soil series "boxes" definitely demands that such a soil series be newly established. Since this research effort provides us an inventory of existing soil series, we will also avoid establishing a new soil series where we have already an existing soil series of similar morphology, physiographic position, nature of parent material, and genetic history. Were it not for the concept of geomorphic surface, it would be almost impossible to complete this book by differentiating those similar soil series in every respect. This book is certainly not the final list, but should serve as the initial inventory of Philippine soils.

The Soils of the Philippines is part of the *World Soils Book Series* that contain details on the soils of various countries. The World Soils Book Series features soil survey history, climate, geology, geomorphology, major soil types, soil maps, soil properties, soil classification, soil fertility, land use and vegetation, soil management, soils and humans, soils and industry, and future soil issues. The importance and relevance of this book becomes more significant considering that rapid urbanization and the dynamic transformation of Philippine economy from agricultural to industrial brings to extinction vast areas of prime agricultural lands. As a number of animal and plant species that represent our biodiversity heritage are threatened by extinction, so are our soil resources.

The Soils of the Philippines represents the current state of the art in our understanding of Philippine soils. The international soil science scene advances in leaps and bounds as we in BSWM make the effort to keep in pace with the developments. Much of these developments especially in soil survey and classification are already reflected in our newly released soil survey manual, but a few of the major changes are yet to be implemented in actual field survey work and in our data and information warehousing (the Soil Information System) which needed also to be overhauled, and not just updated nor just upgraded. This will be Version 3 as the first version was mainframe-based and the second version was a subsystem under the Agricultural Resources Information System that included warehousing other major data outputs of BSWM. What we wanted is not just a web-accessible and Geographic Information Science (GIS)-based Soil Information System, but also an information system that could provide the varied data needs of local and international clientele.

The demand for soil resources information has also expanded in recent decades and we have to participate in several multi-agency and international collaborative consortia involving a variety of global issues pertaining to resources management within and outside the traditional agricultural arena. Soil science is traditionally taught in agricultural colleges and universities, and hence most of us have agricultural leanings and background. Soil data are mostly interpreted for agricultural purposes. But many of our clients now are in non-agricultural fields—architecture, civil works, forestry, and the various disciplines of botanical and life sciences, environmental science, natural resources management, rural development planning, policy and legislation, and other relevant branches of earth sciences. In fact, soil geography, with its socioeconomic dimension, is now emerging, for which soil survey, classification, and mapping should make a strong presence.

The Soils of the Philippines sums up all that we have been doing since the start of soil survey work in the Philippines from 1903 until the present. It is a homage to these men and women who have contributed to more than a century of soil survey work. It is a fitting tribute to BSWM's soil resources assessment activities on the occasion of her 62nd

Anniversary, as BSWM was re-established after the Second World War in 1951 and remains the sole nationally mandated authority on Philippine soils to this day. We believe this book also paves a positive future for soil survey and classification in the years and decades to come.

Quezon City, Philippines, December 2012 Rodelio Carating

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