CAVE MANAGEMENT, PROTECTION AND CONSERVATION STRATEGY AND ACTION PLAN (CMPCSAP) 2019-2028

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EXECUTIVE SUMMARY

CMPCSAP 2019-2018

The Philippines, an archipelago of more than 7,100 islands, has an extensive karst landscape approximately 35,000 km^2 (11.7% of the total land area of the country) (Day & Urich, 2000), formed during the Tertiary and Quaternary periods (Balazs, 1973). The karst landscape is characterized by the presence of soluble limestone rocks, sinkholes, caves, and underground drainage system through which energy and water move (Gunn, 2004).

Given that karsts have complex geological and hydrological characteristics, they are among the most fragile and vulnerable environments in the world (Brinkmann & Parise, 2012). The majority of caves in the Philippines are made of soluble limestone rocks. Cave biodiversity is extremely unique and very susceptible to natural and man-made disturbances. In addition to biodiversity values, caves are known for their archaeological/paleontological, historic, cultural, recreational, aesthetic, educational, research and economic values, which when not sustainably managed can compromise their ecological integrity.

Recognizing the importance of caves and karst landscapes, a strategic action plan is needed to conserve and sustainably manage caves and karsts in the Philippines.

The Cave Management, Protection and Conservation Strategy and Action Plan (CMPCSAP) is a major aspect in the implementation of the Cave Management, Protection and Conservation Program (CMPCP), which was established in accordance with the National Caves and Cave Resources Management and Protection Act (RA No. 9072 of 2001) and its Implementing Rules and Regulations (DAO No 2003-29). It is also consistent with the Philippine Development Plan for 2011-2016, Philippine Biodiversity Strategy and Action Plan (PBSAP) (2015-2018), and Aichi Biodiversity Targets (2011-2020).

CMPCSAP is a product of two national consultations held on 29 April 2017 and on 21 March 2018. The inputs from DENR Regional Offices, cave researchers and enthusiasts were taken into account in drafting the Action Plan. The issue on gender equality was incorporated in the Plan. The consultation was also participated in by the technical staff from BMB, DENR Regional Offices and other concerned agencies and organizations. CMPCSAP has also benefited from the comments and suggestions from a range of participants in conjunction with the series of national and regional consultations for the drafting of the Philippine Biodiversity Strategy and Action Plan (PBSAP) (2015-2018).

The CMPCSAP focuses on the management and conservation actions that have to be implemented from 2017 to 2028. The action plan embodies the set goals of the six components of CMPCP, namely (a) Cave resource assessment and classification, (b) Resource management and utilization, (c) Visitor management, (d) Conservation, education, and public awareness, (e) Human resource development, and (f) Research and development.

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CMPCSAP provides the strategic framework to meet its:

Vision: To maintain and conserve the biodiversity of caves and karst landscape including their hydrological, geomorphological, and recreational attributes as well as to promote sustainable resource use and to enhance appreciation of their natural, cultural, and historic values for the present and future generations

Mission: To implement the Cave Management Protection and Conservation Program (CMPCP) as mandated by the Cave Act and DAO 2003-29.

General Objectives:

1. To formulate and implement relevant policies, plans and programs
2. To enhance human resource development, research, and public education through a democratic, consultative, transparent, and participatory engagement with local communities and relevant stakeholders, and
3. To monitor the progress of the implementation of the CMPCP

The Department of Environment and Natural Resources (DENR), the lead national government organization charged with implementing the CMPCP, collaborates with the National Museum, National Historic Institute, Department of Tourism, and relevant Local Government Units. The Palawan Council for Sustainable Development is the lead implementing body in the Province of Palawan (RA. No.7611). The roles of the National Cave Committee, Regional Cave Committees, and Provincial Cave Committees are also pivotal in ensuring the success of the action plan. So as not to compromise the short- and long -term goals set in the action plan, the collective action of the government and its partners from the public and private sectors including the local communities is essential and urgent.

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Cave Management, Protection and Conservation Strategy and Action Plan (CMPCSAP) 2019- 2028

Caves in the Philippines are important biodiversity and cultural heritage assets. They are home to diverse and unique life forms many of which are yet to be named and discovered. The archaeological, palaeontological, historic, recreational, scientific, and educational values of caves cannot be underestimated.

The environmental conditions of the karst ecosystem can have significant effects on the integrity of caves. Many caves and the resources therein remain unexplored and yet they are increasingly being damaged by indiscriminate human use. It is crucial that the protection and management of the tangible and intangible values of caves are foremost in planning and management. Recognizing the importance of caves and karst landscapes, the Philippine government and several international organizations have been encouraging their urgent conservation and sustainable use.

PART 1 - KARST and CAVES

Karst

Karst consists of geologic features such as rocks and minerals, including a groundwater system formed from soluble bedrock, as well as various types of biota and habitats.

Karsts straddle several kilometers of galleries, crevices, cracks, and fissures beneath the Earth's surface. The Philippines has an extensive karst landscape approximately 35,000 km^2 or 11.7% of the total land area of the country (Day & Urich, 2000). Limestone is the major rock underlying the karst landscape in the country, formed during the Tertiary and Quaternary periods (Balazs, 1973).

Karsts are complex geological formations. Karst outcrops can be rugged, steep, or dome-shaped. In the Philippines, the dominant karst landforms such as towers and cones are common. The karst landscape is also characterized by the presence of aquifers, sinkholes, and caves (**Table 1).**

Table 1. Karst contains caves of varying sizes and depths (Examples).

Name of cave	**Characteristics**
Langun-Gobingob Caves/Calbiga Cave (Samar)	Considered the largest (2,968 ha) cave in the Philippines and the world's third largest karst formation. It is the second largest in Southeast Asia. It is 7 km long with an area of 900 km^2, with 12 huge chambers filled with spectacular speleothems.
Puerto Princesa Underground River in Palawan	With more than 24 km in length, it is known to be the second longest navigable underground river in the world; with many inter-twining chambers and passages.
Tulingon Cave in Aklan	About 20 km long, with enormous guano deposits

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Nagbituka 1 Palawan (east side of Mount St. Paul)	Considered the deepest cave, approximately 270 m deep

Karst Aquifers

Karst acts as an aquifer where water can be stored and returned to the surface. Karst aquifer provides 40-50% of the world's drinking water (Brinkmann & Parise, 2012). About 20-25% of the world's population depends on water supplied by karsts (Ford & Williams, 2007). The Philippines depends on water supplied by karsts; about 63% of groundwater is consumed for drinking and other domestic purposes, 17% for agriculture, 13% for industry, and 7% for other purposes (Philippine Environment Monitor, 2003).

Caves

Caves are major components of the karst landscape. A cave system, which can be spectacularly complex, is a subterranean world of chambers, galleries, passages, and rivers.

From the explorer's point of view, caves are "openings in the Earth large enough for human exploration. From the biologist's point of view, they are openings that will accommodate cave-adapted organisms. From a hydrologist's point of view, they are segments of subsurface conduits that transmit water through karst aquifers" (White & Culver, 2012, p.103).

The "National Caves and Cave Resources Management and Protection Act (RA 9072/2001, Section 3) defines cave as:

> "any naturally occurring void, cavity, recess or system of interconnected passage beneath the surface of the earth or within a cliff or ledge and which is large enough to permit an individual to enter, whether or not the entrance, located either in private or public land, is naturally formed or man-made. It shall include any natural pit, sinkhole or other feature which is an extension of the entrance. The term also includes cave resources therein, but not any vug, mine tunnel, aqueduct or other man-made excavation."

Types of Caves

Limestone caves are the most common type of caves. The different types of solution caves in the Philippines include anchialine, littoral and marine caves as well as sinkholes, each with unique geological features and life forms.

Anchialine Caves

Anchialine caves are "partially or totally submerged coastal caves in volcanic or karst limestone terrain that contain tidal, marine waters having a longer (months to years) residence time" (Iliffe & Bishop, 2007, p.1). The anchialine caves in the Philippines are found along the coastline or

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within a few kilometers inland from the shore (e.g., Lamao Caves in Dingalan, Aurora). Anchialine habitats may be considered brackish wetlands because of the mixing of seawater and freshwater at the cave entrance. Because the mixing zone is influenced by the oceanic tides and water currents, seawater-freshwater mixing diminishes as the distance from the cave entrance increases. In Puerto Princesa Underground River, seawater enters and mixes with freshwater up to 6 km from the cave entrance (de Vivo *et al.*, 2009). No mixing occurs in the much deeper passages, and the heavy seawater stays below the less dense freshwater.

Underwater Caves

Underwater caves are caves or sections of a cave that are completely filled with water, and are characteristically impassable without scuba gear. Little is known about the physical and biological attributes of underwater caves in the Philippines, although anecdotes and testimonials from experienced cave divers can be instructive.

Underwater caves may occur inland or at sea. Springs are a good example of inland underwater caves because they are typically inundated with ground water. The Enchanted River and freshwater spring in Surigao del Sur conceal an 80-meter underwater cave. However, not all springs qualify as underwater caves.

Marine caves (also known as submarine or sea caves) are common features of the littoral zone on rocky coastlines with cliffs. Sea caves are formed when sustained wave action erodes weak areas along the sea-facing cliffs, effectively converting the rock face to honeycomb-like formations over time. Caves facing open seas can be approached and explored in small boats. During low tide, some caves can be explored on foot. Deep Sea caves can be as small as crevices or large enough to accommodate a person or two. Submarine caves may have been formed from the fluctuations of sea level and global ice-volume many thousands of years ago (Iliffe & Kornicker, 2009).

The known underwater caves in the Philippines are also popular recreational diving sites such as those in Puerto Galera in Oriental Mindoro (e.g., Shark Cave, Hole in the Wall) and Tres Reyes Island in Marinduque. The popular Marigondon Cave in Mactan (Cebu) is also a major dive site in the Philippines. The underwater cave (700-750 m) in Lake Bababu (Dinagat Island) has long attracted divers and tourists.

Sinkholes

Sinkholes are among the most common landforms associated with karst landscapes in the Philippines. Sinkholes form when a relatively thin layer of earth collapses unexpectedly into a subterranean cavity previously unknown to lie beneath surface soil.

Sinkholes range in size (1m to 600+m) in both diameter and depth; all have vertical entrances. Sinkholes range from shallow (bowl- or saucer-like) to deep (requiring rappels or ladders for entry) (Gunn, 2004). The Chocolate Hills of Bohol are dotted with natural sinkholes between the brown mounds of earth that give the area its name. Many of these sinkholes are sufficiently deep as to hold rainwater for sustained periods of time. Such rainwater pools are important wetland habitats for a number of native and migratory birds.

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The development of sinkholes depends on the geological characteristics of an area, intensity of geologic processes, and rate/nature of infrastructure development. It can be natural or artificially induced. The devastating earthquake in Bohol in October 2013 triggered the formation of several cover-collapse sinkholes in the vicinity of the epicenter. Cover-collapse sinkholes especially in populated areas can cause considerable damage to life and property

Cave Decorations

Limestone caves are adorned with a wide range of fascinating rock formations called speleothems. At least 38 different types of speleothems have been described worldwide based on formation mechanisms and dominant biogeochemical reactions (Lee *et al.*, 2012). The types of minerals and/or organic compounds in the calcite solution, which are brought in from the surface and from minerals in cave sediments, determine the color and transparency of speleothems.

Among the most common and attractive speleothems in the Philippines are the conical stalactites and stalagmites. Stalactites are limestone formations hanging from the cave ceiling like icicles. Stalagmites are formed on the cave floor by the water dripping from the ceiling; they project upward and tend to be more massive than the stalactites. When a stalactite and a stalagmite join, a column or pillar is formed.

Cave formations are of different types. Some examples are:

- Soda straws – stalactites that are thin, slender, and hollow, resembling drinking straws.
- Drapery – thin sheets of calcite that look like curtains hanging from the ceiling.
- Flowstone – calcite sheets that look like waterfalls; drip water flowing down over the cave floor creates flowstone, which can cover large areas especially when water flows slowly down a slope.
- Rimstone dam – a depression on the cave floor with calcium deposits along the edges, giving the appearance of a dam; as deposits pile up, more water accumulates in the depression to form a water pool.
- Helictites – twisted and delicate speleothems on cave walls and floors without particular orientation with respect to gravity. A very rare kind of helictite, referred to as 'calcite grass,' grows extensively from the cave floor of the 150 Year Gallery of Puerto Princesa Underground River (de Vivo *et al.*, 2013).

Cave Biota

Karsts and caves are considered "arks of biodiversity" because they provide refuge to numerous species (Clements *et al.*, 2006). In comparison with the overlying surface area, the diversity of cave-dependent organisms is much lower because caves have fewer, fragmented, and relatively inaccessible habitats as well as reduced food sources. High biodiversity is almost always associated with large caves with much more numerous and varied microhabitats. Given that only 10% of caves in the world have been explored, it would not be surprising if more and new species are to be discovered in the future.

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Animals found in caves are referred to as troglofauna (for terrestrial organisms) and stygofauna (for aquatic/marine organisms), with both surface and underground species frequently co-existing. Animals that live on the surface are referred to as epigeanic; those that live underground, hypogeanic. For the purpose of this strategic action plan, the subterranean fauna is classified into troglobites, troglophiles, and trogloxenes. Aquatic/marine fauna are classified accordingly as stygobites, stygophiles, and stygoxenes.

Troglobites/Stygobites

Underground animals that spend their whole life in caves and cannot survive outside are obligate cave dwellers, referred to as troglobites (or stygobites when referring to aquatic species). Special adaptations, such as lack of pigmentation, reduced eyes, and longer appendages are exhibited by these organisms.

The global estimate of obligate cave-dwellers is about 50,000 to 100,000 species (Culver & Holsinger, 1992). Crustaceans constitute 43% of the total known diversity of obligate aquatic-dwelling species in the world (Gibert & Culver, 2009). In the Philippines, there are 34 species of stygobiotic crustaceans (Brancelj *et al.*, 2013). Thus far, only 13 stygobitic fish species have been described from Southeast Asia (Clements *et al.*, 2006). A blind cave fish in the Philippines is the goby (*Caecogobius cryptophthalmus*) from Langun-Gobingob Caves on Samar Island (Berti & Ercolini, 1991).

Troglophiles/Stygophiles

Troglophiles are facultative animals that are found in caves only during certain stages of their life cycles, such as roosting, reproduction, and nursing the young. Troglophiles usually live in the entrance or twilight zones of caves and do not go out during the day in full light.

Bats are the most common, conspicuous, abundant, and diverse vertebrates in Philippine caves (Heaney, L. in BMB, 2017). Insect-feeding swiftlets (Family Apodidae) are widely distributed and commonly seen in limestone karsts in the Philippines; some of them produce edible nests. The dominance of troglophilic bats, followed by swiftlets, in nearly all caves in the country has also been observed during the cave assessments (1996- 2013) of the DENR regional offices.

Trogloxenes/Stygoxenes

Trogloxenes make casual visits to caves but never complete their whole life cycle there; they are not considered cave obligates. They are generally surface (epigean) species and do not have any special adaptations that are typical of 'true' cave dwellers. As would be expected, the diversity of trogloxenes, such as several limestone frogs and lizards (Brown, R. in BMB, 2017), is likely to be highest at or near the entrance of the cave. The biospeleological classification of many of these species, including some cave-dwelling crustaceans, insects, spiders, and mollusks, may be re-considered or changed as more information about their biology and ecology are obtained.

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Accidentals

Organisms that are accidentally introduced into the caves by flood or strong stream flow or wind or with the help of other animals, including humans, are not permanent cave dwellers. Accidentals are not adapted to cave environment and tend to go back to their usual habitats. Those that cannot return to the surface or are trapped in the dark zone would fall prey to predators.

Microorganisms

The majority of microorganisms known to survive in caves are represented by bacteria and fungi, which are generally ubiquitous. There is no or very limited information about the biospeleological classification of microorganisms. The literature on microbial communities in subterranean environments is scant and mostly restricted to certain caves in Europe and the United States.

Cave microorganisms have both harmful and beneficial impacts on cave ecosystems. Some microorganisms are essential in the decomposition of guano and other organic and inorganic materials that become food source of many cave-dwelling species, particularly invertebrates. Others can significantly influence the formation and preservation of speleothems and other cave deposits.

A number of fungi are pathogenic to humans and other animals such as bats. Cave fungi can be introduced and spread by bats, rodents, insects as well as humans. *Histoplasma capsulatum* is the most widely studied fungus; it is common in cave sediments enriched with bird or bat guano. It has also been isolated from cave air and water. When inhaled, spores of this fungus can cause histoplasmosis, a potentially fatal mammalian disease considered endemic to Southeast Asia, India, Australia, Africa, and parts of South America and North America. The incidence of histoplasmosis, which can affect humans, has been reported in the Philippines (Bulmer & Bulmer, 2001).

A diversity of bacteria from biofilms in Bulalon and Mapanghe Caves (Polillo Island, Quezon Province was reported by Pulido-De Leon (2009). Their study revealed the presence of *Escherichia coli, Salmonella* sp., *Serratia marcescens, Pseudomonas aeruginosa,* and *Bacillus subtilis*. Their study found that the water inside the cave was highly contaminated with these microorganisms probably from the feces of bats and birds as well as humans.

Nearly all of the 60 viral species reported to be associated with bats can potentially generate emerging and recurring infections in humans. Bats that can potentially transmit harmful viruses to humans include those under Families Pteropodidae, Molossidae, Phyllostomidae, and Vespertilionidae (Wong *et al.*, 2007). People that are most vulnerable to bat rabies due to frequent exposures include guano miners, bat hunters, spelunkers, cave tourists, and park rangers.

There is serologic evidence of lyssavirus infections among Philippine bats (e.g., *Rousettus amplexicaudatus, Eonycteris spelaea, Mineopterus schreibersii*) that were sampled from selected islands in the Philippines (Arguin *et al.*, 2002). Several authors suggest that both insectivorous bats (e.g., *Rhinolophus* and *Miniopterus*) and frugivorous bats (Pteropodidae) are the primary

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natural hosts of Ebola virus. The genus *Rousettus* has been implicated as a reservoir of Reston Ebolavirus in the Philippines (Taniguchi *et al.,* 2011).

PART II- THE CAVE MANAGEMENT, PROTECTION AND CONSERVATION PROGRAM (CMPCP)

The Cave Management, Protection and Conservation Program (CMPCP) was established in accordance with the National Caves and Cave Resources Management and Protection Act (RA No. 9072 of 2001) and its Implementing Rules and Regulations (DAO No 2003-29). The implementation of CMPCP is also consistent with the Philippine Development Plan for 2011-2012 (PDP, 2011).

The Department of Environment and Natural Resources (DENR), in coordination with the National Museum (NM), National Historical Commission of the Philippines (NHCP), Department of Tourism (DOT), and relevant Local Government Units (LGU), is the lead national body tasked to implement CMPCP. The Palawan Council for Sustainable Development (PCSD) is the lead implementing body in the Province of Palawan (RA. No. 7611).

The management of CMPCP is the direct responsibility of the National Cave Committee, chaired by the Director of the Biodiversity Management Bureau or BMB (formerly the Protected Areas and Wildlife Bureau). A Regional Cave Committee (RCC), chaired by the Assistant Regional Director for Technical Services and co-chaired by the Regional Director of the Mines and Geosciences Bureau, is established in every administrative division or region of the country to ensure the smooth implementation of the Program within their respective jurisdiction. However, in situations where RCCs cannot be convened primarily due to geographical location as in many island provinces, a Provincial Cave Committee (PCC) may be established instead. To date PCCs, chaired by the DENR PENRO, have been set up in Region 4B except in Palawan. Each of these committees (national, regional and provincial levels) is represented by Local Government Units, concerned coordinating agencies, members of the civil society and stakeholders. In Palawan, the Environment and Natural Resource Committee assumes the role of the Cave Management Committee, composed of members from the National Museum, National Historical Commission of the Philippines, Department of Tourism, and Local Government Units through the League of Mayors (PCSD Resolution No. 13-484/2013).

The objectives of CMPCP embody the principles of sustainable development, namely the formulation and implementation of relevant policies, plans, and programs; biodiversity conservation; sustainable use of cave resources; human resource development; research and development; and public education. All program activities are to be undertaken in consultation with local communities and relevant stakeholders.

The components of CMPCP (Section 11, DAO No.2003-29) are as follows:

1. Cave resource assessment — inventory and mapping of caves; classification and documentation of biological, geological, hydrological, palaeontological, archaeological, historical resources, and other relevant cave information

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2. Resource management and utilization — regulation of the consumptive and non-consumptive uses of caves and cave resources
3. Visitor management — development of caves for ecotourism; regulation of cave visitors and their impacts
4. Conservation, education, and public awareness — promotion of public awareness, appreciation, and understanding of the importance and benefits of caves and cave resources; cave protection and conservation
5. Human resource development — improving manpower capability to manage and conserve caves through trainings and workshops
6. Research and development — implementation of research and developmental projects in support of policy development, management, and protection of caves.

1. Cave Resource Assessment and Classification

Of the nearly 2,500 known caves in the Philippines, about 18% have been officially classified as of 2015 in accordance with DENR Memorandum Circular 2007-04. A standardized field template was developed by the National Cave Committee as guide for cave assessment (DENR Memorandum Circular 2007-04). The *Handbook on Cave Classification for the Philippines* (DENR-PAWB, 2009) provides basic field procedures and guidelines for cave classification.

The DENR Regional Director, through the Regional/Provincial Cave Committee or the Protected Area Management Board, approves the list of caves that have been assessed and classified within its management jurisdiction. The Regional Office will then submit such list together with the supporting documents (i.e., assessment report, map, and RCC/PCC/PAMB resolution) to the Biodiversity Management Bureau for consolidation and listing of classified caves. The draft annual list of caves is eventually submitted to the DENR Secretary for final approval.

The cave classification system is comprised of three classes, namely:

Class I – Caves with delicate and fragile geological formations, threatened species, archaeological and palaeontological values, and extremely hazardous conditions. Allowable activities are limited to mapping, photography, educational, and scientific purposes.

Class II – Caves with areas or portions which have hazardous conditions and contain sensitive geological, archaeological, cultural, historical, and biological values or high quality ecosystem. It may be necessary to close section of these caves seasonally or permanently. It is open to experienced cavers or guided educational tours/visits.

Class III – Caves with no known threatened species and archaeological, geological, natural history, cultural, and historical values. They are considered safe for inexperienced visitors and may be utilized for economic purposes such as guano extraction and edible bird's nest collection.

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Inventory data

As of 2016:

- 455 caves have been classified; Region 2 has the highest number of caves (**Fig.** 1)
- Caves classified as Class I (13%, n= 60), 68% (n= 310) classified as Class II, and 19% (n= 85) classified as Class III (**Fig. 2**).

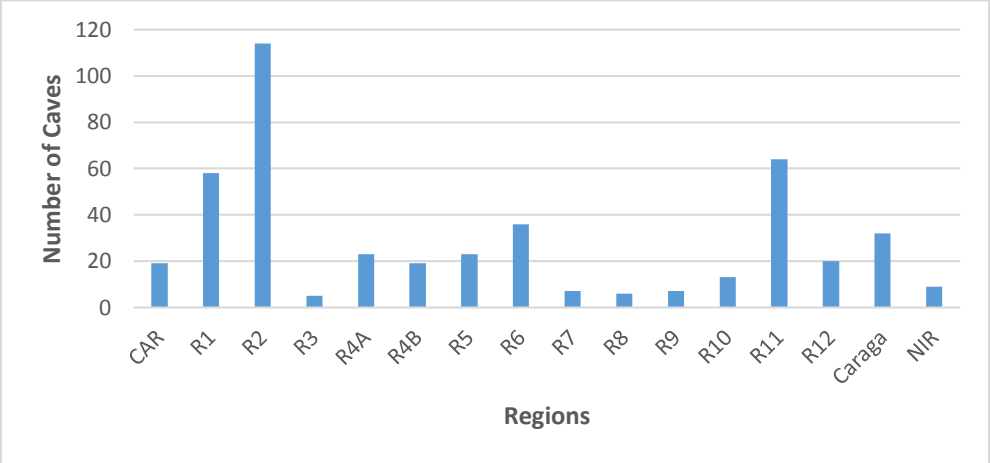

Fig. 1. Total number of classified caves per Region as of 2016.
Reference: DENR Memorandum Circular Nos. 2012-03, 2014-03, 2015-08, and 2016-05

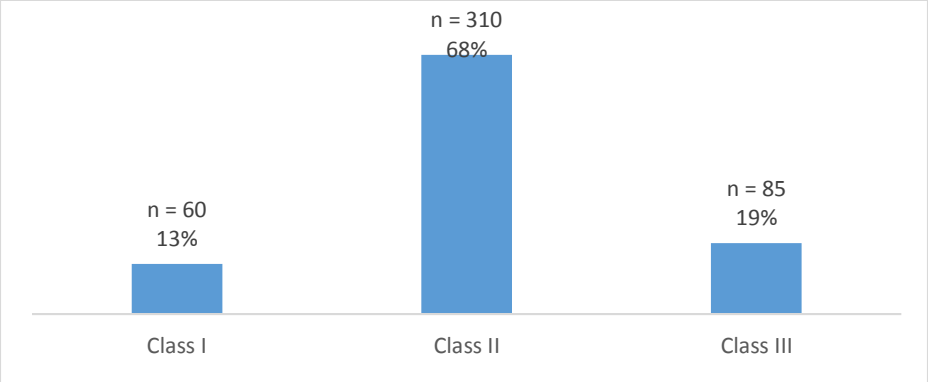

Fig. 2. Number of caves per class groupings as of 2016 (Total caves = 455)
Reference: DENR Memorandum Circular Nos. 2012-03, 2014-03, 2015-08, and 2016-05

Caves within Protected Areas (NIPAS)

Caves are protected in various ways such as through the establishment of protected areas consistent with the National Integrated Protected Areas System (NIPAS) Act or Republic Act No. 7586.

Other area-based conservation measures include the establishment of local conservation areas, critical habitats, and heritage sites.

As of 2016, the Philippines has established 240 Protected Areas of which 18 PAs have classified caves. **Figure 3** shows that out of the 455 caves classified as of 2016, 167 (37%) are located in NIPAS sites; the rest (63%, n= 288) are located either in other government-owned timberland or privately owned land or land with claimants. All caves inside NIPAS sites, regardless of class level, should be managed in accordance with the NIPAS Act. On the other hand, Class I and Class II caves, even though found outside NIPAS sites, should also be protected in accordance with other relevant rules and regulations.

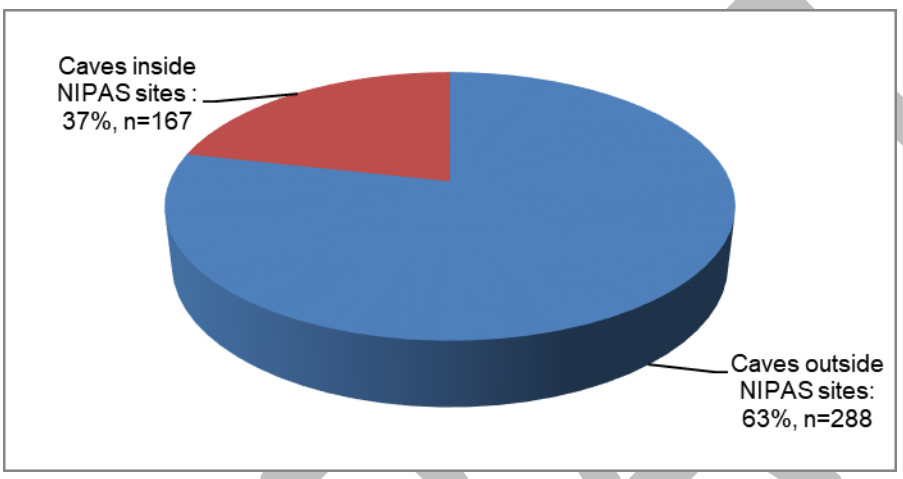

Fig. 3. Classified caves inside and outside NIPAS sites as of 2016.
Reference: DENR Memorandum Circular Nos. 2012-03, 2014-03, 2015-08, and 2016-05

Caves within other Conservation Areas

In addition to caves found inside NIPAS sites, there are other protected caves established under different protection/conservation categories, such as geological monuments, historical sites, and archaeological reservations (**Table 2**).

Table 2. Protected caves in the Philippines under different protection/conservation categories.

Non-NIPAS Management Category	**Name of protected sites (Location)**	**Policy Order**
National Geological Monuments	- Montalban Gorge in Wawa (Rizal) - Puerto Princesa Subterranean River National Park (Palawan)[1]	Executive Order No. 625/1980

	- Chocolate Hills Natural Monument (Bohol)[2] - Hundred Islands National Park (Pangasinan)[2]	
National Historical Sites	- Pamitinan (Rizal)[-] - Pinagrealan (Bulacan) - Biak-na-Bato (Bulacan)[2]	- Republic Act 4846/1966 - Presidential Decree No. 374/1974 - Republic Act No. 10066/2010
Site Museum Reservation	-Lipuun Point Reservation/Tabon Complex (Cagayan Valley)	- Presidential Proclamation No. 996/1972) - Republic Act No. 10066/2010
Archaeological Reservation	- Several archaeological sites in Cagayan Valley and Kalinga-Apayao	- Presidential Decree No. 1109/1977) - Republic Act No. 10066/2010
National Cultural Treasures	- Angono Petroglyphs (Rizal) -Kabayan Mummy (Benguet)	- Presidential Decree No. 260)/ 1973 - Republic Act No. 10066/2010

[1] PPSRNP is also a NIPAS site, UNESCO Biosphere Reserve, UNESCO-World Natural Heritage Site, ASEAN Heritage Park, Wetlands of International Importance (Ramsar Site), and one of the Seven New Wonders of Nature.
[2] Also established as NIPAS sites

2. Resource Management and Utilization

The management and utilization of caves and cave resources are built on the results of field cave assessments and classification pursuant to Section 13 of the DENR Administrative Order No. 2003-29 or the Implementing Rules and Regulations of the RA 9072 (Cave Act). Government permits on cave utilization may be issued in accordance with Section 14 of DAO 2003-29.

Sustaining the benefits derived from caves is essential for their sound management. Caves along with their karstic landscape provide tangible and intangible benefits. Tangible benefits are quantifiable goods such as food, water, and other commodities whereas intangible benefits are the ecosystems services such as groundwater recharge, clean air and water, aesthetic and recreation and plant pollination.

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More specifically, the benefits provided by caves and karsts are as follows:

a. Archaeological and Palaeontological Benefits

The archaeological and palaeontological information about caves have helped in understanding the environmental, social, and economic events of the ancient past. Information on archaeology and paleontology can also show the distribution, ecological function, and origins of prehistoric life forms. In the Philippines, scientific explorations have unearthed rich collections of artifacts and ecofacts that embody the history of the country for the past ~60,000 years. Some of these collections are recognized as National Cultural Treasures (National Museum of the Philippines, 2014).

b. Religious and Historical Benefits

Caves have been used as burial and ritual sites that characterize the cultural heritage and tradition of many indigenous communities. The nine caves excavated in southeastern Bohol were used for burial and religious activities during prehistoric times (Ronquillo, 1995). Indigenous burial practices and rituals associated with caves continue to be practiced in the Philippines, such as among the Sagada people of Mountain Province.

Caves have also played a significant role in contemporary religious practices. In the Philippines, some caves are used as places of worship (e.g., Callao Cave in Cagayan), while others are visited by devotees during Lent for religious and spiritual reasons (e.g., Sagrada Familia Cave in Zambales).

Some caves in the Philippines have historical significance. The Filipino revolutionary leader, Andres Bonifacio, declared the nation's independence and inscribed the words "*Viva la Independecia Filipinas*" on the walls of Pamitinan Cave in Rizal. The Pinagrealan Cave in Bulacan was used by the first Philippine President - Emilio Aguinaldo - as a refuge during the Filipino-American War.

c. Biological and Ecological Benefits

Caves provide enormous biological benefits to cave-dwelling organisms, in particular bats and swiftlets - two of the most well-known fauna in cave ecosystem.

Bats are the most common and abundant cave vertebrates in the Philippines. The ecological and economic values of bats are numerous given their ecological roles in crop pollination, seed dispersal, and natural pest control. Furthermore, bats are a popular tourism drawcard, useful in biological research, and effective educational tool. Bat guano is vital to cave productivity, being the main source of energy and nutrients of a wide variety of cave decomposers. Bat guano is exploited commercially worldwide as organic fertilizer because of its high nitrogen and phosphorus content.

Like the insectivorous bats, insectivorous swiftlets can control agricultural pests. In the karstic areas of Niah (Sarawak, Malaysia), swiftlets can consume up to 11 metric tons of insects

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(Vermeulen & Whitten, 1999; Clements *et al*., 2006). The nests produced by the Edible-nest Swiftlet (*Collocalia fuciphaga*) and the Black-nest Swiftlet (*Collocalia maximus*) are high-value food products and are very much in demand because of their high nutritional value. The white nest of the Edible-nest Swiftlet can fetch up to US$2,000-4,000 a kilo (Sankaran, 2001).

d. Recreational and Aesthetic Benefits

The labyrinth of chambers and passages adorned with spectacular speleothems in caves draws many domestic and international tourists. Cave tourism worldwide caters to approximately 25 million visitors per year, generating an annual income of US$2.3 billion (Cigna & Burri, 2000). In the Philippines, one of the most popular cave tourism destination is the Puerto Princesa Underground River – a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site.

With the increasing popularity of cave tourism, the associated adverse ecological and socio-cultural impacts have become problematic; however, they can be prevented or minimized through sound and sustainable tourism management, planning and implementation. It is anticipated that the revenue from cave tourism will not only augment local economy and livelihood opportunities but also generate broad support for cave conservation. Balancing these benefits against the adverse consequences of tourism on caves and the surrounding karstic ecosystem requires close collaboration and collective action. Best-practice management in tourism is crucial to sustaining tourism.

f. Research, Scientific, and Educational Benefits

Caves are excellent outdoor laboratories for learning geology, hydrology, history, archaeology and palaeontology including specialized fields in biology such as evolutionary biology, geobiology, geomicrobiology, and astrobiology (White & Culver, 2012). Cave science or speleology is an interdisciplinary science which requires thorough understanding not only of caves themselves but also the landscape, drainage basin, and rock units in which they occur. Through speleology, numerous discoveries were made in the various fields of science such as archaeology, palaeontology, geology, and palaeoclimatology. For instance, analysis of stalagmites in Tine Cave in Negros Occidental has shown the implication of rainfall variability in low latitudinal Asian region for the past 2,800 years; this study revealed an abrupt drying at approximately 1150 BP toward the Late Tang Weak Monsoon period (Hori *et al*., 2009).

3. Visitor Management

About 20 million people worldwide visited caves in 1996 (Gillieson, 1996). In the Philippines, the most visited cave is the Puerto Princesa Underground River which was visited by a yearly average of 268,383 visitors from 2011 to 2013 (PPRSNP-PAMB Financial Report, 2014). Unless visitation is managed, the ecological integrity of caves will be compromised.

Visitor management involves regular monitoring and assessment of visitor number and impacts. Cave tourism involves recreational activities with varying degrees of excitement and difficulties, ranging from simply viewing rock formations in show caves to more strenuous and adventurous

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exploration in deep caves. In both passive and active recreational activities, respect for caves is crucial to minimize environmental impact while ensuring human safety and enhanced tourist experience. Visitor impact management requires an adaptive approach through regular monitoring and appropriate and timely actions (Catibog-Sinha, 2012).

Given the increasing demands for cave tourism, a set of guidelines on cave ecotourism (BMB Technical Bulletin No. 2017-01) was issued by BMB in 2017. The guidelines underscore the features of caves (i.e., biological, geological, hydrological, archaeological and palaeontological) that should be taken into account in planning and management to minimize tourism impacts and ensure the safety of visitors and the sustainability of caving activities. Also included in the guidelines is the code of conduct for tour guides and visitors. As specified in in Section 4 General Consideration of BMB Technical Bulletin 2017-01 (Guidelines in Safeguarding Caves Utilized for Ecotourism), only Class III and certain sections of Class II caves may be used for ecotourism. Each of these caves should have a management plan including a zoning scheme built on the results of a thorough and systematic cave assessment.

4. Conservation, Education, and Public Awareness

BMB, in partnership with relevant organizations (e.g. National Museum, Mines and Geosciences Bureau, Gaia Exploration Club) and other stakeholders, has published several information materials in support of the Cave Act and other cave policies and regulations. These materials provide policy and management guidelines not only to cave managers, spelunkers and tour operators but also to the general public.

- *A Handbook on Cave Classification for the Philippines (2009)* - outlines field procedures stipulated in DENR Memorandum Circular No. 2007-04 (Procedure in Cave Classification) and the Manual on Cave Classification.

- *Philippine Cave Primer (2012)* – provides general information about caves and key management guidelines for the conservation and sustainable use of management of caves, cave resources including certain caving activities.

- *Philippine Caves: Beneath the Earth's Surface-Conservation and Management* (2017) – a semi-technical book, which aims to promote public awareness and understanding of caves. The book consists of nine chapters focusing on a range of topics such as cave biodiversity, archaeology, palaeontology, ecotourism, benefits, human threats, management and conservation including relevant government policies and regulations.

Other national agencies/organizations, such as the National Museum, publish guidebooks on several archaeological sites (e.g., Balobok Rock Shelter, Tabon Complex), underscoring the biological, cultural, and ecotourism features of these caves as well as prescribing ways to sustainably use and conserve them for perpetuity (Bautista, 2004; Bautista & Ronquillo, 2009).

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5. Human Resource Development

BMB, in collaboration with cave experts and other stakeholders, has been organizing capacity building activities for selected staff of DENR and members of the Regional Cave Committees to increase their technical capacity and skills on cave management and conservation. These activities are in the form of practical training on cave assessment, classification, mapping, cave rescue, and field research. In October 2014, a training on cave rescue was conducted in Sagada, Mt. Province, which was participated in by local tour guides and members of local rescue units (e.g., fire fighters, local police officers). A video documentation of the said event was developed for future training programs.

BMB, alongside the National Cave Committee, initiated the First Philippine Cave and Karst Forum in 2016. This forum provided the platform, which allowed free exchange of knowledge among cave researchers, managers, students, and other stakeholders. In addition, workshops, technical meetings and congresses (e.g., Annual Cave Congress) have been held under the leadership of BMB and other partner agencies. The collective efforts of caving groups, relevant government and non-government organizations, academic institutions, and concerned stakeholders contributed to the success of these activities.

6. Research and Development

The Ecosystem Research and Development Bureau (ERDB), the designated research and development arm of DENR, is mandated to conduct, among others, research and policy studies on caves and cave resources. On the other hand, BMB provides logistical support towards the implementation of R&D programs initiated by academic and research institutions (e.g., University of the Philippines Diliman, University of the Philippines at Los Baños, and the National Museum).

Cave experts from non-government organizations (i.e., Philippine Speleological Society, Filipino Cave Divers) collaborate with other cave researchers in various speleological field studies. The research expeditions of La Venta Association and partner institutions/organizations in Puerto Princesa Underground River and nearby caves within Mount St Paul have also been generating valuable scientific data on caves (de Vivo *et al*., 2013; La Venta, 2013).

PART III- THREATS AND IMPACTS ON KARTS AND CAVES

Karst landscapes, which cover 10-20% of the Earth's surface (Ford & William, 2007), are among the most fragile and vulnerable ecosystems in the world. Man-made and natural disturbances of karsts and caves have accelerated over the years. The increasing anthropogenic impacts are associated with increasing human population and insatiable material demands.

From 1996 to 2013, DENR Regional Offices reported various human impacts on caves. The following are the impacts recorded with their corresponding possible environmental consequences (**Table 6**):

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Table 6. Human adverse impacts on caves and cave resources.

Human activities	**Environmental consequences (Examples)**
Mining and quarrying resources inside and outside caves (e.g., for guano, speleothem, limestone, phosphate rocks)	Destruction of karst forests and caves, soil erosion, hydrology alteration/disruption, water pollution, surface subsidence, groundwater pollution, siltation, loss of habitats, species endangerment Destruction of archaeological and palaeontological materials deposited in the sediments
Exploitation of cave biota (e.g., bats, bird's nest)	Biodiversity loss, species endangerment
Deforestation of karstic forest/watershed	Water depletion, hydrology alteration/disruption, soil degradation, loss of habitats, species endangerment
Agriculture and grazing	Water depletion, hydrology alteration/disruption, loss of native vegetation cover, pollution from chemicals e.g., fertilizers, herbicides, and pesticides; soil compaction, soil erosion, species endangerment
Road and building construction	Direct and indirect damage on geological features, degradation/loss of biodiversity, alteration of hydrologic properties and dynamics, blockage of natural drainage, change of natural and cultural karst landscapes
Human settlement	Water depletion, hydrology alteration, habitat loss, species endangerment, soil erosion, ground water pollution, change of natural kastic landscape
Pollution (including vandalism and graffiti)	Contaminated runoff and seepage from various areas and activities e.g., farms, gardens, resorts, landfills, dumping industrial and domestic wastes, hospital solid/liquid wastes, and dead animal carcasses; well abandonment, damage on cave walls and speleothems
Mass/unsustainable tourism	Deterioration of caves due to the accumulation of trash, vandalism, extraction for souvenir, and mere touching of speleothems; damage to cave natural features due to introduction of infrastructures such as lightings, buildings, paths, etc.
Irresponsible cave exploration for research and teaching	Habitat disturbance, species endangerment, soil degradation, pollution

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PART IV. POLICIES AND LEGISLATIONS

Enabling policies are crucial in achieving economic and ecological sustainability. The following is a list of the national policies establishing the conservation and protection measures for caves in the Philippines. The Palawan Council for Sustainable Development (PCSD) also issues specific resolutions drawn from relevant national laws and implementing rules and regulations. The Local Government Units (LGUs) by virtue of the Local Government Code of the Philippines (Republic Act No. 7160) are authorized to implement certain aspects of the national laws and administrative orders. The specific resolutions, all built on national legal frameworks, that have been issued by PCSD and LGUs are not included in the list below.

1. Enabling Laws (Republic Acts, Presidential Executive Orders, Presidential Proclamations) Relevant to the Conservation of Caves in the Philippines

Table 3. Enabling laws on cave management and conservation.

Code/ year signed	Title	Responsible lead institution
Republic Act No. 9072/2001	An Act to Manage and Protect Caves and Cave Resources and for other Purposes, also known as the *National Caves and Cave Resources Management and Protection Act*	DENR, PCSD
Republic Act No. 7942/1995	An Act Instituting a New System of Mineral Resources Exploration Development, Utilization, and Conservation, also known as the *Philippine Mining Act*	DENR, DA, PCSD
Republic Act No. 10066/2010	An Act Providing for the Protection and Conservation of the National Cultural Heritage, Strengthening the National Commission for Culture and the Arts (NCCA) and its Affiliated Cultural Agencies, and for other Purposes, also known as the *National Cultural Heritage Act*	NCCA
Republic Act No. 8492/1998	An Act Establishing a National Museum System, Providing for its Permanent Home and for other Purposes, otherwise known as the *National Museum Act*	National Museum of the Philippines
Republic Act 4846/1966	An Act to Repeal Act No. 374 and to Provide for the Protection and Preservation of Philippine Cultural Properties, also known as the *Cultural Properties Preservation and Protection Act*	National Museum of the Philippines

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Code/ year signed	Title	Responsible lead institution
Presidential Decree No. 37/1974	Amending Certain Sections of Republic Act No. 4846 (known as Cultural Properties Preservation and Protection Act)	National Museum of the Philippines
Republic Act No. 7586/1992	An Act Providing for the Establishment and Management of National Integrated Protected Areas System, Defining its Scope and Coverage, and for other Purposes, also known as the *National Integrated Protected Areas System (NIPAS) Act*	DENR
Republic Act No. 9147/2001	An Act Providing for the Conservation and Protection of Wildlife Resources and their Habitats, Appropriating Funds therefore and for other Purposes, also known as the *Wildlife Resources Conservation and Protection Act*	DENR, DA, PCSD
Presidential Executive Order No. 111/1999	Establishing the Guidelines for Ecotourism Development in the Philippines	DENR, DOT
Presidential Executive Order No. 625/1980	Creating a National Committee on Geological Sciences (declaration of National Geological Monument)	DENR
Presidential Decree No. 1586/1978	Establishing an Environmental Impact Statement System, Including other Environmental Management Related Measures and for other Purposes	DENR
Presidential Proclamation No. 2146/1981	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	DENR

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2. Rules and Regulations (Department Administrative Orders, Memorandum Order) Relevant to the Conservation of Caves in the Philippines

Table 4. Enabling rules and regulations on the cave conservation and management.

Code/date	Title
DENR Administrative Order No. 04/1994	Establishing the Cave Management and Conservation Program (CMCP) and Providing Funds

Code/date	Title
DENR Administrative Order No 29/2003	Implementing Rules and Regulations of the National Caves and Cave Resources Management and Protection Act (Republic Act No. 9072
DENR Administrative Order No. 34/2007	Guidelines on Treasure Hunting in Caves
DENR Memorandum Circular No. 04/2007	Procedures in Cave Classification
DENR Administrative Order No.19/2013	Guidelines on Ecotourism Planning and Management in Protected Areas
DENR Administrative Order No. 12/2016	Adopting the Philippine Biodiversity Strategy and Action Plan
DENR Memorandum Circular No. 03/2012	List of Classified Caves
DENR Memorandum Circular No. 03/2014, 08/2015, and 05/2016	List of Additional Classified Caves
DOT-RR 120/1999	Rules and Regulations to Govern the Accreditation of Cave Guides Pursuant to the Provisions of Executive Order No. 120
Memorandum	Implementing Rules and Regulations of R A. No, 10066 or the National Cultural Heritage Act

3. Technical Bulletins on Caves

Table 5. Technical bulletins on caves.

Code/year	Title
PAWB Technical Bulletin No. 05/ 2013	DENR-LGU-Landowner Memorandum of Agreement Template
PAWB Technical Bulletin No. 06/2013	DENR-LGU Memorandum of Agreement Template
BMB Technical Bulletin No. 10/2016	Outline of Cave/Wetland Management Plan
BMB Technical Bulletin No. 01/2017	Guidelines in Safeguarding Caves Utilized for Ecotourism

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PART V. CAVE MANAGEMENT, PROTECTION AND CONSERVATION STRATEGY AND ACTION PLAN (CMPCSAP)

CMPCSAP provides the strategic framework to protect and conserve Philippine caves and karsts as well as sustainably manage the resources therein. Good conservation and management outcome are dependent on the collective action of the government and its partners from the public and private sectors including the local communities who serve as the custodians of these irreplaceable natural assets.

CMPCSAP is consistent with the National Caves and Cave Resources Management and Protection Act (RA No. 9072 of 2001) and its Implementing Rules and Regulations (DAO No 2003-29). The implementation of CMPCP is also consistent with the Philippine Development Plan for 2011-2016, Philippine Biodiversity Strategy and Action Plan (PBSAP) (2015-2018), and Aichi Biodiversity Targets (2011-2020).

Consultation Process

CMPCSAP is a product of two national consultations held on 29 April 2017 and on 21 March 2018. The inputs from DENR Regional Offices, cave researchers and enthusiasts were taken into account in drafting the Action Plan. The issue on gender equality was incorporated in the Plan. The consultation was also participated in by the technical staff from BMB, DENR Regional Offices and other concerned agencies and organizations. CMPCSAP has also benefited from the comments and suggestions from a range of participants in conjunction with the series of national and regional consultations for the drafting of the Philippine Biodiversity Strategy and Action Plan (PBSAP) (2015-2018).

Guiding principles

The principles that should guide relevant organizations, both government and non-government, in the management of caves and karsts are as follows:

1. Caves and cave resources along with the surrounding karsts are significant and irreplaceable biodiversity and heritage assets that should be conserved, protected, and sustainably managed.
2. An adaptive and holistic approach to management of caves is embraced as a collective effort of both government and non-government organizations and the civil society.
3. Gender equity of staff and participants in the conservation and management of caves is taken into account in relevant training and employment opportunities as well as in all other aspects of community participation.
4. Participation of the local communities and residents including concerned indigenous people in planning and management is essential in all aspects of cave conservation and sustainable use.
5. Equitable and fair benefit-sharing from the benefits that accrue from the sustainable use of caves and resources are paramount.
6. The level of significance of caves based on the national cave classification system as well as the urgent state or condition being faced by caves due to natural and man-made disturbances serve as a basis in setting management priority.

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7. Monitoring the management targets and performance set for each individual cave action plan is to be undertaken on a regular and transparent basis by a relevant multi-sectoral group.
8. The management of Philippine caves, cave resources and karsts is consistent with existing legislation, rules and regulations of the country and is well-aligned with the prescribed targets and principles of the Aichi Target, PBSAP and PDP.

CMPCSAP is comprised of six goals corresponding to the six components of the CMPCP (Section 11 of DAO 2003-29).

Goal 1. Caves and Cave Resource Assessment and Classification

Objective 1. To conduct gender-balanced survey, assessment and classification of caves

Objective 2. To identify and set aside caves with high conservation value for national and/or international protection

Objective 3. To develop and implement individual cave management plan

Goal 2. Resource Management and Utilization

Objective 1. To formulate and implement policies on the sustainable use of cave resources

Goal 3. Visitor Impact Management

Objective 1. To manage selected caves as sustainably managed ecotourism destinations/ attractions

Objective 2. To manage and monitor visitor impacts on caves

Goal 4. Conservation, Education and Public Awareness

Objective 1. To develop and implement communication and education strategy

Goal 5. Human Resource Development

Objective 1. To enhance human capacity and capability in the assessment, management and monitoring of caves

Goal 6. Research and Development

Objective 1. To develop/enhance the implementation and monitoring of basic and applied research on caves

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REFERENCES

Arguin, P., Murray-Lillibridge, K., Miranda, M., Smith, J., Calaor, A., & Rupprecht, C. (2002). Serologic evidence of Lyssavirus infections among bats in the Philippines. *Emerging Infectious Diseases*, 8 (3), 258-262.

Balazs, D. (1973). Karst in the Philippines. *International Speleology II, Subsection Ba: Geomorphology of the Karst Surface*, 19-38.

Bautista, A. (1995). *Fossil remains of rhinoceros from the Philippines.* Papers of the National Museum of the Philippines 5 (1), 1-9.

Bautista A., & Ronquillo, W. (2009). *Balobok Rock Shelter, Barangay Lakit-Lakit, Bongao, Tawi-Tawi Province*. Manila: National Museum.

Berti, R., & Ercolini, A. (1991).*Caecogobius cryptophthalmus* n. gen. n. sp. (Gobiidae Gobiinae), the first stygobic fish from Philippines. *Tropical Zoology, 4* (1), 129-138.

Biodiversity Management Bureau (2017). *Philippine Caves: Beneath the Earth's Surface - Conservation and Management*. Quezon City, Department of Environment and Natural Resources - Biodiversity Management Bureau, 294 pp.

Brancelj, A., Boonyanusith, C., Watiroyram, S., & Sanoamuang, L. (2013). The groundwater-dwelling fauna of Southeast Asia. *Journal of Limnology, 72* (2), 327-344

Brinkmann, R., & Parise, M. (2012). Karst environments: Problems, management, human impacts, and sustainability – an introduction to the special issue. *Journal of Cave and Karst Studies, 74*, 135-136.

Bulmer, A., & Bulmer, G. (2001). Incidence of histoplasmin hypersensitivity in the Philippines. *Mycopathologia*, 149 (2), 69-71.

Catibog-Sinha, C. (2012) *Sustainable tourism: Concepts and case studies - Caring for nature, culture and people.* Manila: Haribon Foundation Inc.

Cigna, A., & Burri, E. (2000). Development, management and economy of show caves. *International Journal of Speleology, 29* B (1/4), 1-2.

Clements, R., Sodhi, N., Schiilthuizen, M., & Ng, P. (2006). Limestone karsts of Southeast Asia: Imperiled arks of biodiversity. *Bioscience*, 56, 733-642.

Culver, D., & Holsinger, J. (1992). How many species of troglobites are there? *National Speleological Society Bulletin*, 54, 79-80.

Day, M., & Urich, P. (2000). An assessment of protected karst landscapes in Southeast Asia.*Cave and Karst Science*, 27, 61-70.

DRAFT

Department of Environment and Natural Resources-Protected Areas and Wildlife Bureau (DENR-PAWB). (2009). *Cave Classification Handbook*. Quezon City: PAWB-NEF.

De Vivo, A., Piccini, L., & Forti, P. (2013). Some scientific features of Puerto Princesa Underground River: One of the new 7 Wonders of Nature (Palawan, Philippines). *16th International Congress of Speleology Proceedings*. Retrieved from www.researchgate.net.

Ford, D., & Williams, P. (2007). *Karst hydrogeology and geomorphology*. Chichester, UK: John Wiley & Sons.

Gillieson, D. (1996). *Caves: Processes, development, and management*. Oxford: Blackwell.

Gibert, J., & Culver, D. (2009). Assessing and conserving groundwater biodiversity: An introduction. *Freshwater Biology, 54*, 639-648.

Gunn, J., (2004). *Encyclopedia of caves and karst science.* New York: Fitzroy Dearborn

Hori, M., Shen, C., Siringan, F., Mii, H., Wu, C., & Kano, A. (2009). Stalagmite-inferred late Holocene precipitation evolution in the tropical western Pacific from Tine Cave, Negros Occidental, Philippines. *American Geophysical Union*, Fall Meeting 2009. Retrieved from http://adsabs.harvard.edu/cgi-bin/basic_connect?qsearch=caves+philippines&version=1.

Iliffe, T., & Bishop, R. (2007). Adaptations to life in marine caves. In P. Safran (Ed.), *Fisheries and aquaculture, encyclopedia of life support systems*. Oxford: Eolss Publishers.

Iliffe, T., & Kornicker, L. (2009). Worldwide diving discoveries of living fossil animals from the depths of anchialine and marine caves. *Smithsonian Contributions to the Marine Sciences*, pp. 269-280. Retrieved from smithsonianrex.si.edu/index.php/scms/article/view/470.

La Venta. (2013). *The river of swallows. A brief guide to the environmental features of Puerto Princesa Underground River*. Retrieved from http://www.laventa.it/documenti/approfondimenti/palawan/2013_DeVivoetal_Palawan_TheRiverOfSwallows.pdf

Lee, N., Meisinger, D., Aubrecht, R., Kovacik, L., Saiz-Limenes, C., *et al*. (2012). Caves and karst environments. In E. Bell (Ed.), *Life at extremes: Environments, organisms, and strategies* (pp. 320-344). CABI International.

National Museum of the Philippines (NMP). (2014). *National Museum archaeological collections.* Retrieved from http://www.nationalmuseum.gov.ph/nationalmuseumbeta/Collections/Archaeology.html

DRAFT

Philippine Environment Monitor. (2003). Water quality. *World Bank Group Report*. Retrieved from http://www.worldbank.org.ph.

Puerto Princesa Subterranean River National Park – Protected Area Management Board (PPRSNP-PAMB). (2014, July). *Financial Report*.

Pulido-De Leon, M. (2009). *Exploration of the microbial diversity of caves in the Philippines and its biotechnological potential: Bacterial biofilm formation of Bulalon and Mapanghe caves in the Polilio Island, Quezon Province [Philippines]*. UPLB-funded Basic Research Program 909. pp. 21. Retrieved from ovcre.uplb.edu.ph

Ronquillo, W. (1995). Anthropological and cultural values of caves. *Philippine Quarterly of Culture and Society, 23* (2), 138-150.

Sankaran, R. (2001). The status and conservation of the Edible-nest Swiftlet (Collocalia fuciphaga) in the Andaman and Nicobar Islands. *Biological Conservation, 87*, 283-294.

Taniguchi, S., Watanabe, S., Masangkay, J., Omatsu, T., Ikegami, T., Alviola, P., *et al*. (2011). Reston Ebolavirus antibodies in bats in the Philippines. *Emerging Infectious Diseases*, 17 (8), 1559-1560. Retrieved from http://wwwnc.cdc.gov/eid/article/17/8/10-1693_article.

Vermeulen, J., & Whitten, T. (1999). *Biodiversity and cultural property in the management of limestone resources – Lesson from East Asia*. The International Bank of Reconstruction and Development/World Bank: Washington, D.C.

White, W., & Culver, D. (2012). *Encyclopedia of caves*. Second edition. Salt Lake City: Academic Press.

Wong, S., Lau, S., Woo, P., & Yuen, K.(2007). Bats as a continuing source of emerging infections in humans. *Review in Medical Virology*, 17

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CAVE MANAGEMENT, PROTECTION AND CONSERVATION STRATEGY AND ACTION PLAN (CMPCSAP)

2019-2028

Vision: To maintain and conserve the biodiversity of caves and karst landscape including their hydrological, geomorphological, and recreational attributes as well as to promote sustainable resource use and to enhance appreciation of their natural, cultural, and historic values for the present and future generations

Mission: To implement the Cave Management Protection and Conservation Program (CMPCP) as mandated by the Cave Act and DAO 2003-29.

General Objectives:

1. To formulate and implement relevant policies, plans and programs
2. To enhance human resource development; research; and public education through a democratic, consultative, transparent, and participatory engagement with local communities and relevant stakeholders.
3. To monitor the progress of the implementation of the CMPCP

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GOAL 1. CAVES AND CAVE RESOURCE ASSESSMENTAND CLASSIFICATION

Objective 1. To conduct gender-balanced survey, assessment and classification of caves

Intervention (actions)	**Targets**	**Indicators (measurable outcome)**	**Target Timeline**			**Responsible Entity/ies (*Lead)**	**Aichi Target**	**PBSAP Target**	**PDP Target**
			S	M	L				
Conduct cave survey, assessment, and classification while providing equal opportunities for both men and women to participate	Focal persons (regional) are assigned and capacitated ensuring gender parity in trainings on cave surveying, assessment, and classification	Trained focal persons with knowledge on cave surveying, map, assessment, classification including cave management	x	x	x	DENR Regional Offices*, DENR-BMB,DENR-EMB, DENR-MGB, PCSD, NM, NHCP, DOT, LGUs Caving groups	19	16	1
		Sex-disaggregated data on focal persons and decision-making bodies	x	x	x				1
	A reasonable number of caves per region are classified annually (i.e., in proportion to the total number of caves identified in a given year) until 2028 using	Assessment reports on cave bio-geo diversity data and cave distribution maps (using dots to indicate geographic locations including surface geo-tagged photos and panoramic view)	x	x	x	DENR-BMB, DENR Regional Offices*, DENR-EMB, DENR-MGB, PCSD, NM, NHCP, LGUs	19	16	1

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	prescribed techniques	per province or Region							
		Length (in meters or kilometers) of cave passages assessed to be specified on cave maps and assessment reports	x	x	x	DENR-Cave Assessment Team*, DENR-BMB, PCSD, RCC, PCC, LGUs	19	16	1
		Recommended list of classified caves	x	x	x	DENR-Cave Assessment Team*, DENR-BMB, PCSD, RCC, PCC, LGUs	19	16	1
	A Department Memorandum Circular is issued	Department Memorandum Circular on official list of classified caves	x	x	x	DENR-BMB*, DENR			

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Objective 2. To identify and set aside caves with high conservation value for national and/or international protection

Intervention (actions)	Targets	Indicators (measurable outcome)	Target Timeline			Responsible Entity/ies (*Lead)	Aichi Target	PBSAP Target	PDP Target
			S	M	L				
Identify caves for inclusion in the NIPAS, Critical Habitat, other governance regimes and/or international heritage listings	At least 10% of the caves identified in a given year(s) are included in NIPAS, Critical Habitat and other governance regimes	List of caves identified for inclusion in the NIPAS, Critical Habitat, other governance regimes, and/or international heritage listings	x	x	x	DENR-BMB*, Regional Offices, RCC, PCC, PCSD, NM, NHCP, LGUs	11	19	1
		Endorsement of caves for inclusion in the NIPAS, Critical Habitat, other governance regimes, and/or international heritage listings	x	x	x				1
	At least 1% of the recommended classified caves in a given year(s) are proposed	Number of proposals submitted		x	x	NCC, DENR-BMB	11	19	

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	for national legislation								
	At least 0.5% of the classified caves in a given year (s) are nominated as outstanding heritage or conservation site for global recognition	Recommended caves or cave systems with recognition as globally important heritage or conservation sites		x	x	NCC, DENR-BMB			

Objective 3. To develop and implement individual cave management plan

Intervention (actions)	**Targets**	**Indicators (measurable outcome)**	**Target Timeline**			**Responsible Entity/ies (*Lead)**	**Aichi Target**	**PBSAP Target**	**PDP Target**
			S	**M**	**L**				
Develop and implement a cave management plan alongside a monitoring program for each cave	A holistic management plan including a Cave Monitoring Program for each DENR-approved classified cave or cave system	Number of management plans formulated Number of management plans implemented	x	x	x	DENR-Regional Offices*, RCC, PCC, PCSD, NM, Concerned LGUs, POs (if applicable)	4	16	1

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	is formulated and implemented with participation of IPs and both men and women								
		Number and list of local partnerships on cave management	x	x	x	DENR-Regional Offices*, RCC, PCC, PCSD, Concerned LGUs, Concerned Landowners			1
		Functional Cave Monitoring Criteria and Evaluation Scheme	x	x	x	DENR-Regional Offices*, RCC, PCC, PCSD, Concerned LGUs, NCC			1
	Cave management plans are harmonized, as appropriate, with other plans such as NIPAS Management Plan, Wetland Action Plan, PBSAP, NISSAP	Management plans implemented in accordance with existing legislations and harmonized/integrated with existing biodiversity management plans	x	x	x	DENR-Regional Offices*, RCC, PCC, DENR-BMB, PAMB, PCSD, Concerned LGUs	4	16	1
	Public-private collaboration in the management	Number of Cave Conservation Agreements with	x	x	x	DENR- Regional offices*, DENR-BMB, PCSD,	4	16	1

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	and conservation of caves is strengthened	LGUs, landowners and other stakeholders including IPs and women organizations, as applicable				Concerned LGUs and Landowners, DOT			
Implement cave restoration and/or clean-up program/ projects in vandalized caves	Clean-up and/or restoration projects in selected vandalized caves are conducted	Reports including photos on clean-up and/or restoration projects	x	x	x	DENR-Regional offices*, RCC, PCC, DOT, PCSD, concerned LGUs, landowners, tour operators, tourists	15	14	2
Formulate and implement a policy on hazard pay/insurance for implementors of cave management plans	Policy on hazard pay/insurance for cave implementors of management plans is formulated and implemented	Policy on hazard pay/insurance	x			DENR-BMB*			

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GOAL 2. RESOURCE MANAGEMENT AND UTILIZATION

Objective 1. To formulate and implement policies on the sustainable use of cave resources

Intervention (actions)	Targets	Indicators (measurable outcome)	Target Timeline			Responsible Entity/ies (*Lead)	Aichi Target	PBSAP Target	PDP Target
			S	M	L				
Formulate and enforce policies on the sustainable use of cave resources	Export and import of speleothems and speleogens is banned	Policy guidelines on the export and import of speleothems and speleogens in place	x	x		DENR-BMB, NCC, DENR-MGB, NM, LGUs	5	16	
		Number of incidents/cases filed including sex-disaggregated data on offenders	x	x	x	DENR-BMB*, NCC, DENR-RCC, PCC, ERDB, PCSD, LGUs			
	Harvesting/collection of guano and edible birds' nests is regulated	Cave-specific policy guidelines on harvesting/collection of guano and edible birds' nests including the equitable sharing of accrued economic benefits	x	x		DENR-BMB*, PCSD, RCC, PCC, NCC, NM, LGUs	5	16	1
		Number of incidents/cases filed including sex-disaggregated data on offenders	x	x	x	DENR-BMB, RCC, PCC, ERDB, PCSD, NM, LGUs			
	A regular monitoring system of	Functional monitoring system developed and implemented	x	x	x	DENR-BMB*, RCC, PCC, NCC, DENR-	5	8	

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	licensed cave resource extraction is developed and implemented	Number of apprehensions made including sex-disaggregated data on offenders	x	x	x	regional offices, PCSD, NM, concerned LGUs	5	8	
		Amount of penalties collected	x	x	x				
Formulate and implement policies on the management and monitoring of visitor impacts on caves	Recreational activities that can adversely impact cave ecosystems (e.g. biking) including vandalism (e.g. graffiti) are prohibited and monitored	Trends in apprehensions and penalties imposed including sex disaggregated data on offenders	x	x	x	DENR-Regional offices*, DOT, PCSD, RCC, PCC, LGUs	14	16	1
	A protocol on underwater cave diving is formulated and implemented	Protocol on underwater cave diving	x	x		Regional offices, DENR-BMB, RCC, PCC, NCC, LGUs	5	16	

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GOAL 3. VISITOR MANAGEMENT

Objective 1. To manage selected caves as sustainably managed ecotourism destinations /attractions

Intervention (actions)	Targets	Indicators (measurable outcome)	Target Timeline			Responsible Entity/ies (* Lead)	Aichi Target	PBSAP Target	PDP Target
			S	M	L				
Develop and manage selected caves as sustainable ecotourism destinations/attractions	A visitor interpretation program, which includes pre tour briefing of visitors as well as tour guiding, to enhance tourist experience and conservation awareness is developed and implemented	Visitor interpretation program in place	x	x		DOT*, LGUs*, DENR Regional Offices, NCC, RCC, PCC, DENR-BMB, NM, POs	14	16	1
		Sex-disaggregated number of trained locals as guides for the visitor interpretation program	x	x		DOT*, NCC, DENR-BMB, NM			1
	Policy guidelines on the development on tourism facilities inside and at the entrance of caves (e.g., ladder,	Policy guidelines on tourism facilities inside and at the entrance of caves	x			DENR-BMB*, NCC, DOT, NM, LGUs	14	17	

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	stairways, walk ways, handrails, viewing platforms, lightings, warning and directional signage, etc.), ensuring visitor safety and minimal environmental risk are formulated and implemented								
	Spatial and temporal visitor-use zoning strategies are developed both inside and outside the cave	Spatial visitor-use zoning maps (e.g. 'no go' zone) of both inside and outside the cave Temporal visitor-use zoning schedule (e.g. cave-off day) for both inside and outside the cave	x	x		NCC*, DENR Regional Offices, RCC, PCC, DENR-BMB, DOT, NM, LGUs	14	16	1
	A mandatory visitor registration logbook with sex-disaggregated	Completed visitor logbook registration	x	x	x	DENR Regional Offices*, LGUs	14	16	1
		List of visitors disaggregated by sex	x	x	x				

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	data of visitors is implemented; the logbook may be placed in a convenient location such as in the nearest visitor center or barangay hall								
	A liability waiver system in case cave visitors meet accidents and unforeseen events and/or inflicted with cave-related illnesses is established	Waiver system for cave visitors	x	x		NCC*, DOT, DENR-BMB, LGUs	14	16	1
	A licensing or accreditation system for commercial cave tour operators or guides, which can be cancelled upon	Functional licensing or accreditation system	x	x		NCC*, DENR-BMB, DOT, LGUs	14	16	1
		Trends/Number of licenses/accreditations issued	x	x	x				

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	violations of environmental and human safety regulations is implemented								
	Procedures on user fee collection and benefit-sharing of revenues derived from the use of caves are developed	User fee collection and benefit-sharing system to include local communities and private land owners	x			NCC*, RCC, PCC, DENR-BMB, DOT, LGUs, DRRM	14	16	1
		Percentage of LGU and/or community incomes	x	x	x				
	A response system to accidents is developed and implemented	Functional response system	x	x		NCC*, RCC, PCC, DENR-BMB,DOT, DILG, PNP, LGUs, DRRM	14	16	

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Objective 2. To manage and monitor visitor impacts on caves

Intervention (actions)	Targets	Indicators (measurable outcome)	Target Timeline			Responsible Entity/ies (*Lead)	Aichi Target	PBSAP Target	PDP Target
			S	M	L				
Manage and monitor the impacts of visitors/tourists on caves	Visitor carrying capacity is determined	Visitor carrying capacity is measured/implemented in caves suitable for ecotourism, i.e., Class 2 and Class 3	x	x		DENR Regional Offices*, NCC, RCC, PCC, DENR-BMB, DOT, LGUs	14	16	1
	Regular visitor impact assessment aimed at reducing damage to caves and health risks to humans is conducted	Visitor impact parameters to include the nature, duration and frequency of recreational use	x	x		NCC*, RCC, PCC, DENR-BMB, DOT, LGUs	14	16	1
	Regular water quality analysis of underground water, cave pools, and water drips is performed	Water quality analysis results	x	x	x	DENR-Regional Offices*, DENR-EMB, PCSD, LGUs	14	16	1

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	A Code of Conduct for tourists to minimize visitor impact, prevent accidents and health hazard and damage to caves is developed and implemented	Code of Conduct	x			NCC*, RCC, PCC, DENR-BMB, DOT, NM, LGUs	14	16	1
		Reports on Code of Conduct implementation and compliance	x						**1**

GOAL 4. CONSERVATION, EDUCATION AND PUBLIC AWARENESS

Objective 1. To develop and implement communication and education strategy

Intervention (actions)	**Targets**	**Indicators (measurable outcome)**	**Target Timeline**			**Responsible Entity/ies (*Lead**	**Aichi Target**	**PBSAP Target**	**PDP Target**
			S	**M**	**L**				
Develop and implement a Communication and Education Strategy to	A wider diversity of participants with better understanding	List of parameters to determine levels of awareness	x	x	x	DENR-Regional Offices*, NCC, PCSD, NM, LGUs	1	18	

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enhance public awareness, most especially the marginalized groups (i.e. youth, IPs, and women) on the conservation of caves and cave resources	and appreciation of the values of caves is targeted	Number of partnerships with stakeholders in the conservation of caves and cave resources	x	x	x	DENR-Regional Offices*, NCC, PCSD, NM, LGUs	1	18	
		Presidential Proclamation on cave conservation	x	x		DENR-BMB	1	16	
	The outcome of the Communication and Education Strategy is assessed, necessary improvements are made and gender parity is ensured	Assessment report containing among others, support (non-financial, financial) from community and private sector and awareness levels	x	x	x	NCC, RCC, PCC, DENR-BMB, PCSD, LGUs	1	16	
		Sex-disaggregated list of recipients/participants of information materials/activities	x	x	x				
		Communications materials	x	x	x				

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GOAL 5. HUMAN RESOURCE DEVELOPMENT

Objective 1. To enhance human capacity and capability in the assessment, management and monitoring of caves

Intervention (actions)	Targets	Indicators (measurable outcome)	Target Timeline			Responsible Entity/ies (*Lead)	Aichi Target	PBSAP Target	PDP Target
			S	M	L				
Improve capacity and capability in the assessment, management and monitoring of caves	Easy- to-understand, training manuals and guides on cave management and relevant laws and policies are developed; to be translated in various dialects	List and number of training manuals and guides	x	x	x	DENR-BMB*, DENR Regional Offices, NCC, RCC, PCC, DENR-MGB, DENR-EMB, NDRRMC	7	16	
		Sex-disaggregated distribution list of training manuals and guides	x	x	x				
	Practical trainings (e.g., survey and mapping, cave/underwater caves assessment, economic	Types and number of trainings requested	x	x	x	DENR-BMB*, DENR Regional Offices, NCC, RCC, PCC, LGUs, NGOs	7	16	
		Number of training modules crafted/prepared	x	x	x				

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	valuation, carrying capacity, planning, management, monitoring, rescue, visitor safety and tour/cave guiding, para-legal training) are conducted	Number of trained individuals disaggregated by sex	x	x	x				
		Distribution list of survey equipment	x	x	x				
	Relevant conferences and symposia at the local, regional and national levels are organized	Types and number of conferences and symposia organized	**x**	**x**	**x**	NCC*, DENR Regional Offices, RCC, PCC, DENR-BMB, DOT, Academe, LGUs, NGOs,	7	18	

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GOAL 6. RESEARCH AND DEVELOPEMENT

Objective 1. To develop/ enhance the implementation and monitoring of basic and applied research on caves

Intervention (actions)	Targets	Indicators (measurable outcome)	Target Timeline			Responsible Entity/ies (*Lead)	Aichi Target	PBSAP Target	PDP Target
			S	M	L				
Develop/Enhance basic and applied research on caves	The continuous conduct of studies and research on caves (speleology, archaeology, etc.) is encouraged and supported ensuring gender equality and equity among scientists/ researchers/authors doing cave studies	Number of impact assessments conducted Number of research/studies conducted Number of studies/researches on every type of caves (including underwater caves) Number of partnerships (MOA/MOU) forged/established Number of studies/researches adopted/ applied by stakeholders for management and conservation of caves Number of policies/laws crafted relevant to the studies/researches disaggregated by sex of researchers	x	x	x	Academe*, DENR-BMB, DENR-ERDB, DENR-MGB, DENR-EMB PCSD, CHED, NM, NHCP, UP-NIGS, UP-MSI LGUs, caving groups, cave divers (for underwater caves),	19	16	1
	Basic and applied research to assist in the management and conservation	Number of research proposals on management and conservation of caves and cave resources submitted and approved				Academe*, DENR-BMB, DENR-ERDB, DENR-MGB,			**1**

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	of caves and cave resources is conducted (i.e. biology and ecology of cave biota and of the karst landscape, archaeological exploration, history, setting water quality and air quality standards inside caves, open and closed seasons for the collection of birds' nest, invasive cave species, threatening factors, carrying capacity, impact assessment on implemented cave management plans, economic valuation) ensuring gender equality and equity among scientists/researchers/authors conducting the studies	Sex-disaggregated data on researchers/scientists/organizations conducting cave studies				DENR-EMB PCSD, CHED, NM, NHCP, LGUs, Caving groups, cave divers (for underwater caves			**1**

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	The systematic research or investigation of caves used by threatened and endangered biota (e.g.bats, blind fish, shrimps, swiftlets) is prioritized	List of priority caves for investigation from DENR Regional Offices	x	x		DENR-BMB*, DENR Regional Offices, PCSD, NM Academe, science-based NGOs	19	16	
	A Code of Conduct for researchers and speleologists/explorers is developed and implemented	A Code of Conduct for researchers and explorers	x	x		DENR-BMB*, NCC PCSD	19	16	
		Reports on the implementation of the Code of Conduct including data on researchers adopting the Code and disaggregated by sex	x	x	x				
	Communicating research and monitoring results to relevant staff and stakeholders including marginalized groups (i.e. IPs, women, elderly and youth) is regularly done	Trends in research undertaken	x	x	x	DENR-BMB*, DENR Regional Offices,NCC, RCC, PCC, PCSD, LGUs	19	16	
		Trends in publications	x	x	x				
		Percentage of women staff and stakeholders with access to research and monitoring results	x	x	x				
		Monitoring reports	x	x	x				

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Regulate and monitor research conducted in caves	A system for monitoring and regulating cave research is installed	Number of writeshops on the drafting of the Underwater Cave Assessment/Monitoring Form conducted Number of cave monitoring system and templates Number of writeshops on the drafting of Cave Monitoring Form conducted Number of writeshops on the drafting of cave safety protocols conducted	x	x	x	DENR-BMB*, NCIP, DENR Regional Offices, NCC, RCC, PCC, PCSD, LGUs,	19	16	
		Sex-disaggregated list of researchers	x	x	x				

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