

ASEAN Action Plan for Invasive Alien Species (IAS) Management



**ASEAN CENTRE
FOR
BIODIVERSITY**



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Abbreviations and Acronyms

ACB	ASEAN Centre for Biodiversity
ACCSQ	ASEAN Consultative Committee on Standards and Quality
ACSN	ASEAN Corporate Secretaries Network Meeting
AMS	ASEAN Member States
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
ASEAN CHM	ASEAN Clearing House Mechanism
AWGNCB	ASEAN on Nature Conservation and Biodiversity
AWGEE	ASEAN Working Group on Environmental Education
CABI	Centre for Agriculture and Bioscience International
CBD	Convention on Biological Diversity
CHED	Commission on Higher Education
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals; also known as CMS or the Bonn Convention
COP	Conference of Parties
CSIRO	Commonwealth Scientific and Industrial Research Organisation
GISP	The Global Invasive Species Programme
IAS	Invasive Alien Species
ISSG	Invasive Species Specialist Group
IUCN	International Union for Conservation of Nature and Natural Resources
NGO	Non-government organization
NISSAP	National Invasive Species Strategy and Action Plan
Ramsar Convention	also known as Convention of Wetlands
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice
UNDP	United Nations Development Program
UNEP	United Nations Environment Programme

1 Introduction

1.1 Background

The ASEAN region is one of the world's most biologically diverse regions, comprising eleven-member countries with unique ecosystems and rich natural resources. However, the region faces significant environmental challenges, including invading non-native or invasive species, which threaten the region's ecosystems, biodiversity, and economic development.

Invasive Alien Species (IAS) are defined as non-native species introduced intentionally or unintentionally which cause a negative impact on the environment, biodiversity, and human health. IAS can compete with native species for resources, alter ecosystem functioning, and transmit diseases to native species, leading to their extinction. Invasive species can also cause significant economic losses by damaging crops, fisheries, and forestry. Based on the ASEAN Clearing House Mechanism (ASEAN CHM) for IAS, at least 482 species are recorded in the region. Indonesia and the Philippines have the highest number of invasive alien species in the region, with 305 and 299 species, respectively. The high number of IAS and high species endemism make both countries more vulnerable to the negative impacts of IAS (Von Rintelen et al. 2017).

The Convention of Biological Diversity (CBD) calls on the Parties to "prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species" (Article 8h). The 2019 Global Assessment Report of Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), identified invasive alien species (IAS) as one of the main drivers of biodiversity loss worldwide. The report also indicated that the rate of introduction of new IAS seems higher than ever before and with no signs of slowing. The recently adopted Kunming-Montreal Global Biodiversity Framework (KMGBF) still included a target to address concerns on IAS as it remains an important biodiversity issue that needs to be tackled and addressed at the global, regional and national levels. It is one of the major threats to biodiversity among other drivers of biodiversity loss and a constant threat to fragile ecosystems that incurred high costs of management and control. Aside from the costs, the spread and establishment of IAS resulted in decline or elimination of native species that compromised the ecosystem services, ecological functions, and livelihoods of people dependent on natural resources. The Target 6 of the KMGBF focuses on *reducing the rates of introduction and establishment of other known or potential invasive alien species by at least 50 per cent, by 2030, eradicating or controlling invasive alien species especially in priority sites, such as islands.*

Many countries in the region have taken steps to develop and implement IAS action plans to address the problem of IAS in Southeast Asia. For example, the Philippines has implemented a National Invasive Species Strategy and Action Plan, which aims to reduce the negative impacts of IAS on the country's biodiversity and economy (Biodiversity Management Bureau, 2013). Similarly, Malaysia has developed a National Strategy for Invasive Alien Species, which aims to minimise the negative impacts of IAS on the country's biodiversity and economy (Department of Wildlife and National Parks, 2013). These actions typically involve the regulation of the importation and sale of IAS,

developing early warning systems for the detection and management of new IAS, and implementing measures to control and manage established IAS.

One of the critical challenges in implementing IAS action plans in Southeast Asia is the public's lack of awareness and understanding of the issue. Several countries in the region are implementing education and outreach programs to raise awareness and encourage the public to take an active role in the control and management of IAS. For example, the ASEAN Centre for Biodiversity (ACB) has developed an educational program for primary and secondary school students to teach them about the importance of biodiversity and the threat IAS poses (ASEAN Centre for Biodiversity, 2018).

The ASEAN Action Plan for IAS Management provides specific strategies and actions to achieve the strategic plan's goals. The plan outlines several priority areas for action, including strengthening the legal framework, capacity building and awareness raising, rapid response and control, risk management and prioritisation, research and knowledge management, partnerships and improving prevention and early detection. It aims to promote a regional approach to managing invasive species that recognises the interconnectedness of the region's ecosystems and the need for a coordinated response to the threats of IAS. By working together, ASEAN member countries can share knowledge and resources to prevent the introduction and spread of IAS, control and manage existing populations, and protect the region's biodiversity, environment, and economic development.

1.2 Status of Invasive Alien Species

The CBD defined invasive alien species (IAS) as "alien species whose introduction and/or spread threaten biological diversity". Other definitions also address impacts on economic and human health sectors. An alien species "refers to a species, subspecies or lower taxon, introduced outside its natural past or present distribution, including any part, gametes, seeds, or propagules of such species that might survive and subsequently reproduce" (CBD, 2002). These organisms are sometimes called "exotic", "introduced", "non-native", or "non-indigenous" species. These different terms caused different perceptions from the public toward IAS issues to some extent (Richardson et al. 2000). IAS constitute a significant threat to Indonesia's vulnerable marine, freshwater and terrestrial biodiversity, and people depend on this biodiversity for their livelihoods. The Global Invasive Species Programme (GISP), an international partnership dedicated to addressing the global threat of invasive species, supported countries in South and SE Asia in 2002 to summarise the threats and impacts of IAS in the region, including recommended actions. Delegates of the *South and SE Asia Regional Workshop on the Prevention and Management of IAS: Forging Cooperation throughout South and SE Asia*, concluded that problems of IAS are causing significant ecological, economic, and social damage and pose an ongoing threat to all countries within the region.

In Southeast Asia, IAS had become a significant threat to the region's biodiversity, with numerous species were adapting and establishing themselves in the wild. According to the IUCN Species Survival Commission Invasive Species Specialist Group (ISSG) (2015), Indonesia has the highest number of IAS in SE Asia, with 181 species recorded, compared to 148 in the Philippines and 145 in Malaysia. Based on other information, these are underestimates but an indication that Indonesia is the most invaded country in the region.

According to Von Rintelen *et al.* (2017) The insular nature of Indonesia, along with its high number of endemic species versus an increased number of threatened species and a high number of IAS, makes the country more vulnerable to adverse impacts than any other SE Asian country. The loss of plant species or changes in vegetation structure because of alien plant invasions may have cascading trophic effects (Sakai *et al.*, 2001), especially on other species at higher trophic levels. For example, alien or exotic plant species have been reported to decrease animal fitness and abundance both by ca. 17% (Vilá *et al.*, 2011).

a. Invasive Alien Plant

Based on work done by the Ministry of the Environment and SEAMEO BIOTROP in 2003, there were more than 1,619 alien plant species in Indonesia, of which 331 were invasive plant species. Tjitrosoedirdjo (2005) reported the presence of 1,936 exotic plant species belonging to 87 families, with Asteraceae (162) and Poaceae (120) being the most speciose families. Approximately one-third (651 species) of the total alien species listed are either naturalised or agricultural weeds. Tjitrosoedirdjo (2005) listed five species (e.g., *Eichhornia crassipes*, *Hydrilla verticillata*, *Mimosa pigra*, *Pistia stratiotes*, *Salvinia molesta*) as important Invasive Alien Plant Species (IAPS) in aquatic habitats and 20 species (e.g., *Acacia nilotica*, *Austroeupatorium inulaefolium*, *Chromolaena odorata*, *Lantana camara*, *Mikania micrantha*) in terrestrial habitats. More recently, Setyawati *et al.* (2015) listed 362 plant species from 73 families as invasive in Indonesia.

Examples of the most noxious invasive plants in the Philippines are hagonoy (*Chromolaena odorata*), a fast-growing perennial shrub infesting pastures and plantations (Bea *et al.*, 2019), and ayam/coronitas (*Lantana camara*), a bushy plant introduced for ornamental landscaping. Both plants are on the global list of most invasive species in the world (IUCN/ISSG, 2005). Water hyacinth (*Eichhornia crassipes*) is also in the world's top ten most noxious weeds and has invaded many slow-flowing and high eutrophic wetlands in the Philippines. Cogon grass (*Imperata cylindrica*), although considered a naturalised species by some botanists, has seeds that can be easily spread by wind and tend to become more invasive than others; it now covers about 20% of the country. It also burns quickly during the dry season, thus, preventing native species from re-establishing their natural habitats. Giant salvinia or kariba weed (*Salvinia molesta*) is a water fern cultivated as an ornamental plant but has escaped and become a noxious pest in many regions worldwide; found in lakes, ponds, streams, ditches, marshes, and rivers. The most common reforestation species are exotic and fast-growing, such as bagras (*Eucalyptus deglupta*), gmelina (*Gmelina arborea*), *Acacia auriculaformis*, *Acacia mangium*, and mahogany (*Swietenia macrophylla*) (Uriarte *et al.*, 2007). The dominance of these species in several areas has contributed to ecological landscape changes in the Philippines. Some examples of common invasive aquatic plant species in Thailand include giant salvinia (*Salvinia molesta*), water hyacinth (*Eichhornia crassipes*) (Rayan *et al.*, 2021).

b. Invasive Alien Fauna in Terrestrial (Mammals, reptiles, birds, molluscs, and Insect)

Southeast Asia is home to a diverse range of terrestrial fauna, including many species of mammals, reptiles, and insects. However, the region has also experienced the introduction and spread of several invasive alien species that threaten the native fauna and the ecosystems in which they live. Some of the invasive alien fauna species found in Southeast Asia include:

- Mammals: Several invasive mammal species have been introduced to Southeast Asia, including the wild boar (*Sus scrofa*), black rat (*Rattus rattus*), and Javan mongoose (*Herpestes javanicus*). These species can compete with native mammal species for resources, predate on native species, and transmit diseases.
- Reptiles: The green iguana (*Iguana iguana*) is an invasive reptile species that has been introduced to some countries in Southeast Asia, including Indonesia and Malaysia. This species can negatively impact native reptile populations by competing for resources and preying on native species. The red-eared terrapin or slider, *Trachemys scripta elegans* (Wied), is native to the southeastern United States. This species was reported as an invasive alien species in Singapore and Thailand. Sulaiman (2002) noted that a major concern for conservationists in Singapore was that sliders might outcompete local species, such as the Spiny Terrapin and the Malayan box terrapin, *Cuora amboinensis* (Daudin). Adult sliders are abundant in all ponds, parks and temples in Bangkok (Jenkins 1995, Cox et al. 1998) and have been released into reservoirs and canals and captured in the wild north of Bangkok (cited in Jenkins 1995). They have been described as 'common' in Lumphini Park in southern Thailand (Ransdale 2001). There is also some commercial production and export of sliders, but this is not considered significant (CITES 2003). *Calotes versicolor* has been reported as an introduced reptile in West Java, Indonesia. This species' natural distribution is in South Asia (Cahyadi and Arifin, 2019).
- Birds: At least 16 invasive birds have been identified in Southeast Asia. These raid grain crops, foul urban areas with faecal droppings, compete with native species, and are capable of transmitting zoonotic diseases such as avian influenza (Yap & Sodhi, 2004). The most studied urban invaders in the region are those in Singapore. The Javan myna (*Acridotheres javanicus*) has been alleged to cause a decline in the population of native Oriental magpie robin (*Copsychus saularis*) by competing for nesting sites, in addition to its constant noise and soiling that irritates the public. The house crow (*Corvus splendens*) necessitated a \$0.6 million culling campaign in 2003 in Singapore (Sodhi & Sharp, 2006). Of all the invasive birds in this region, the feral pigeon (*Columba livia*) appears to have the widest distribution. This species has colonised all 10 ASEAN countries, where it fouls structures and clogs drainages, raids crops, and can transmit 30 diseases to people, such as encephalitis and histoplasmosis (Yap & Sodhi, 2004; Sodhi & Sharp, 2006).
- Molluscs: The South American mollusc, *Pomacea canaliculata*, commonly known as the golden apple snail, is a serious pest of rice fields throughout Southeast Asia. In the Philippines the annual cost of this snail to rice agriculture was estimated at \$731–\$2,064 million. It is important to note that this species has also

been considered a serious rice pest in Malaysia and Indonesia where it necessitates regular interventions (Ngiehm et al., 2013).

- Insects: Invasive alien insect species in Southeast Asia include the red imported fire ant (*Solenopsis invicta*), yellow crazy ant (*Anoplolepis gracilipes*), and fall armyworm (*Spodoptera frugiperda*). These species can negatively impact native insect populations, disrupt ecosystem functioning and damage crops. The inventory of alien and potential invasive insects by the Indonesian Agricultural Quarantine Agency (AQA) has identified twelve insect species that could be classified as invasive species (Handayani, 2014). The species are *Agrilus planipennis*, *Anoplophora glabripennis*, *Anthonomus grandis*, *Bactrocera tryoni*, *Ceratitidis capitata*, *Coptotermes formosanus*, *Hypanthria cunea*, *Ips typographus*, *Icerya purchasi*, *Lymantria dispar*, *Sirex noctilio*, and *Trogoderma granarium*. *Liriomyza sativae* Blanchard was identified as invasive in Hanoi province in northern Vietnam. This leafminer species has caused high damage levels to tomatoes, cucumbers, beans, peas, and melons in the Vietnam agriculture sector.

It is important to note that this is not an exhaustive list and other invasive alien fauna species may be present in Southeast Asia. The introduction and spread of invasive alien species pose significant challenges to the conservation of native species and ecosystems in the region, highlighting the need for effective management strategies to prevent and control their spread.

c. Invasive Alien Fish in Freshwater

The negative impacts of invasive fish species in Southeast Asia include the displacement of native biota, which can lead to biodiversity loss. Invasive fish species can also cause economic loss by damaging fisheries and aquaculture practices. They can also alter the structure and function of aquatic ecosystems, leading to changes in water quality, nutrient cycling, and habitat availability. Invasive fish species can compete with native species for resources, such as food and habitat, and prey on native species, leading to population declines. Overall, invasive fish species can have significant negative impacts on the ecological and economic well-being of Southeast Asian countries.

Introduced fish that are well known in Indonesia are mujair (*Oreochromis mossambicus*) and Nile tilapia (*Oreochromis niloticus*) (Wargasasmita, 2017). These two species of cichlid fish have high adaptability and can reproduce with short enough cycles so that shortly, the population of these species in nature is quite high. In the Philippines, these two species are also reported to be a threat to displace native species, for example, against mullet fish (*Mugil cephalus*) and milkfish (*Chanos chanos*), which began to decline in their natural habitat with the introduction of this introduced species (Bartley et al., 2000).

Wargasasmita (2005) recorded 19 introduced fish species in Indonesian waters. Ten introduced fish species were reported in Aceh Province waters and included *Clarias gariepinus*, *C. carpio*, *Oreochromis mossambicus*, *O. niloticus*, *Xiphophorus helleri*, *X. maculatus*, *Pterygoplichthys pardalis*, *Aplocheilus panchax*, *Ctenopharyngodon idella*, and *A. spatula*. Surveys of fish on Mount Galunggung, West Java, discovered

24 species, 13 of which were introduced, including *Clarias gariepinus* and a few *Oreochromis* species (Haryono, 2020).

d. Invasive Alien Marine Biota

Southeast Asia is home to some of the world's most diverse marine ecosystems, but it is also facing significant threats from invasive alien marine species. Invasive species are non-native species that have been introduced to a new environment and have the potential to cause harm to the native biodiversity and ecosystems. There are several invasive alien marine species that are currently affecting Southeast Asia, including: Lionfish (*Pterois volitans*), this species is native to the Indo-Pacific region but has been introduced to the Caribbean and is now considered an invasive species. It has also been reported in Southeast Asia, including the Philippines and Indonesia. Lionfish can cause significant damage to coral reef ecosystems by consuming small fish and invertebrates. *Caulerpa taxifolia*: a species of seaweed that is native to the Indian Ocean but has been introduced to several locations around the world, including Southeast Asia. It can form dense mats that smother native seagrass and coral reef ecosystems. Green mussel (*Perna viridis*): a species of mussel that is native to the Indo-Pacific region but has been introduced to several locations around the world, including Southeast Asia. It can outcompete native species for food and space and can also cause damage to infrastructure such as water intake pipes. The invasion black striped mussel in Southeast Asia are primarily environmentally disturbed inner harbour areas (Bax *et. al.*, 2003).

1.3 Invasive Alien Species Pathways

The pathway of invasive alien species refers to the various means by which non-native species are introduced into new environments, where they can cause harm to the native ecosystem. The Convention on Biological Diversity (CBD) has identified several pathways of introduction. Alien species may arrive and enter a new region through three broad mechanisms: importation of a commodity, arrival of a transport vector, or spread from a neighbouring region (CBD, 2014, herein referred to as CBD pathways categorization). These result in six principal pathways:

Related to transport of a commodity:

- 1) Release in nature refers to the intentional introduction of live alien organisms for the purpose of human use in the natural environment. Examples include for biological control, erosion control (and dune stabilisation), for fishing or hunting in the wild; landscape "improvement" and introduction of threatened organisms for conservation purposes.
- 2) Escape refers to the movement of (potentially) invasive alien species from confinement (e.g., in zoos; aquaria; botanic gardens; agriculture; horticulture; aquaculture and mariculture facilities; scientific research or breeding programmes; or from keeping as pets) into the natural environment. Through this pathway the organisms were initially purposefully imported or otherwise transported to the confined conditions, but then escaped from such confinement, unintentionally. This may include accidental or irresponsible release of live organisms from confinement,

including cases such as the disposal of live food into the environment or the use of live baits in an unconfined water system.

- 3) Transport–Contaminant refers to the unintentional movement of live organisms as contaminants of a commodity that is intentionally transferred through international trade, development assistance, or emergency relief. This includes pests and diseases of food, seeds, timber and other products of agriculture, forestry, and fisheries as well as contaminants of other products.

Related to a transport vector:

- 4) Transport–Stowaway refers to the moving of live organisms attached to transporting vessels and associated equipment and media. The physical means of transport-stowaway include various conveyances, ballast water and sediments, biofouling of ships, boats, offshore oil and gas platforms and other water vessels, dredging, angling or fishing equipment, civil aviation, sea and air containers. Stowaways of any other vehicles and equipment for human activities, in military activities, emergency relief, aid and response, international development assistance, waste dispersal, recreational boating, tourism (e.g., tourists and their luggage) are also included under this pathway.
- 5) Corridor refers to movement of alien organisms into a new region following the construction of transport infrastructures in whose absence spread would not have been possible. Such trans biogeographical corridors include international canals (connecting river catchments and seas) and transboundary tunnels linking mountain valleys or oceanic islands.
- 6) Unaided refers to the secondary natural dispersal of invasive alien species that have been introduced by means of any of the foregoing pathways. Information on the mechanisms of secondary spread of invasive alien species, after their introduction, are relevant to define the best response measures.

1.4 Impact of Invasive Alien Species on Ecosystem

a. Terrestrial

Invasive alien species significantly impact terrestrial ecosystems in Southeast Asia, including forests, grasslands, and agricultural lands. Some of the impacts of invasive alien species on terrestrial ecosystems in Southeast Asia include:

- Competition for resources: Invasive alien species can outcompete native species for water, nutrients, and sunlight. For example, the African tulip tree (*Spathodea campanulata*), an invasive plant species, can form dense stands that shade out and displace native plant species, reducing habitat availability and food for native animals (Wan et al., 2018).
- Predation: Invasive alien species can prey on native species, leading to declines in native populations. For example, the common myna bird (*Acridotheres tristis*), an invasive bird species, can prey on the eggs and young of native bird species, leading to declines in their populations (Feare et al., 2022).
- Disease transmission: Invasive alien species can introduce new diseases or parasites to native species, leading to population declines. For example, the Asian tiger mosquito (*Aedes albopictus*), an invasive mosquito species, can transmit

diseases such as dengue fever, chikungunya, and Zika virus to humans and native wildlife (Bellini et al., 2020; Goubert et al., 2016).

- Habitat alteration: Invasive alien species can alter the physical characteristics of terrestrial ecosystems, leading to changes in soil fertility, water availability, and other factors that affect the health of native species. For example, the giant African snail (*Achatina fulica*), an invasive gastropod species, can consume large amounts of leaf litter and soil, leading to changes in nutrient cycling and soil structure (Raut & Barker 2002; Nicolai & Ansart, 2017).

b. Fresh Water

Invasive alien species have significantly impacted freshwater ecosystems in Southeast Asia, including rivers, lakes, and wetlands. Some of the impacts of invasive alien species on freshwater ecosystems in Southeast Asia include:

- Competition for resources: Invasive alien species can outcompete native species for resources such as food, habitat, and space. For example, the water hyacinth (*Eichhornia crassipes*), an invasive plant species, can form dense mats that block sunlight and reduce oxygen levels in the water, limiting the growth of native aquatic plants and reducing habitat for fish and other aquatic species.
- Predation: Invasive alien species can prey on native species, leading to declines in native populations. For example, the red-bellied pacu (*Piaractus brachypomus*), an invasive fish species, has been known to prey on native fish species in Southeast Asia, leading to population declines.
- Disease transmission: Invasive alien species can introduce new diseases or parasites to native species, leading to population declines. For example, the North American signal crayfish (*Pacifastacus leniusculus*) has been introduced to some freshwater ecosystems in Southeast Asia, where it can carry a disease that is fatal to native crayfish species.
- Habitat alteration: Invasive alien species can alter the physical characteristics of freshwater ecosystems, leading to changes in water flow, sedimentation, and other factors that affect the health of native species. For example, the giant freshwater prawn (*Macrobrachium rosenbergii*), an invasive crustacean species, can alter the structure of riverbeds and cause erosion, leading to changes in the habitat of native species.

Alien fish species also reduce aquatic ecosystem services. For example, Kodiran et al. (2020) conducted an economic analysis of the impact of alien freshwater crayfish (*Cherax quadricarinatus* and *Procambarus clarkii*) in Lake Lido, West Java. Non-native species *Cherax quadricarinatus* were predicted to compete with the native species *Macrobrachium sintangense* for food resources, whilst non-native species *P. clarkii* were predicted to compete with the native species *Macrobrachium rosenbergii*. As such, the economic cost of the loss of the native species resulting from the introduction of these two (2) alien species was estimated to be between \$0,05 and \$0,13 per individual.

c. Marine

Invasive species have transformed marine habitats around the world. The most harmful of these invaders displace native species, change community structure and food webs, and alter fundamental processes, such as nutrient cycling and sedimentation. Alien invasives have damaged economies by diminishing fisheries, fouling ships' hulls, and clogging intake pipes. Although only a small fraction of the many marine species introduced outside their native range can thrive and invade new habitats (Mack et al., 2000), their impact can be dramatic.

Some marine invasive species hitchhike on ships or in ballast water, while well-meaning but misguided aquarium owners intentionally release others. Regardless of how they arrive, marine invasive species risk ecosystems and economies. And in a time of massive global trade where 45,000 cargo ships move more than 10 billion tons of ballast water worldwide each year, conditions are ripe for invasive species to spread.

In the marine environment, high environmental connectivity through the water medium fosters the dispersal of species, rendering efforts to control biological invasions more challenging. The larger the invaded area and the higher the dispersion capacity of the invader, the more challenging it is to control the invader's population (Williams and Grosholz, 2008; Ojaveer et al., 2015). Hence, when selecting the best approach to control a biological invasion, it is crucial to consider the size of the invaded area and the species' dispersion capacity. Eradication of marine invasive species has been achieved in rare cases characterised by early detection and rapid response.

1.5 The significant threat of invasive alien species

Invasive alien species cause harm across a wide range of environmental and human activities, such as:

a. Food security

A significant hazard to food security is posed by invasive alien species, which can have a negative impact on agricultural production, disrupt ecosystems, and reduce the availability of nutritious food. Invasive species can reduce agricultural output by causing crop damage, preying on livestock, and competing for resources with native species. According to a study by Pimentel et al. (2005), invasive species cause approximately \$137 billion in annual agricultural losses worldwide. IAS can disrupt ecosystem services necessary for food production, such as pollination, soil fertility, and water supply. In a review, Vilà et al. (2010) highlighted the effects of invasive alien plants on ecosystem services, such as decreased crop yields and altered nutrient cycling. Aquatic invasive species risk fisheries and aquaculture, threatening fish stocks, aquaculture production, and human livelihoods. Leung et al. (2002) highlighted the effects of invasive species on marine and freshwater ecosystems, emphasising the need for effective management to protect fisheries and food security. A case study by Mistry and Berardi (2016) examined the effects of invasive alien plants on indigenous food systems in the Indian Himalayas,

highlighting the need to integrate traditional knowledge with managing invasive species.

b. Health

Invasive alien species can pose significant threats to human health through various mechanisms, including the transmission of diseases, allergies, and direct physical harm. Invasive species can act as vectors for diseases that can be transmitted to humans, animals, and other native species. Increased incidence of specific diseases. An increase in disease risk may also occur if the introduced IAS is susceptible to and able to transmit local pathogens. Pathogens acquired by IAS may be amplified and spill back to humans and local species. Invasive species of water hyacinth (*Eichhornia crassipes*) can reduce the water quality and encourage mosquitoes, snails and other organisms associated with human illness, including malaria, schistosomiasis, encephalitis, filariasis and cholera. For example, mosquitoes, such as the *Aedes* mosquito species, are known vectors for diseases like dengue fever, chikungunya, and Zika virus. Invasive species that carry diseases can introduce new pathogens or amplify existing ones, increasing the risk of disease transmission in affected areas (Kyle et al., 2008). Ragweed (*Ambrosia* spp.), can produce abundant pollen that triggers allergies and respiratory issues in humans. Exposure to allergenic invasive species can lead to asthma attacks, allergic rhinitis, and other allergic reactions (Ziska et al., 2003). Some invasive species can cause direct physical harm to humans. For instance, certain marine species like lionfish (*Pterois* spp.) have venomous spines that can cause painful stings, leading to injuries and infections. Invasive species with aggressive behaviour, such as certain ant species, can also pose risks by biting or stinging humans (Moran et al., 2013). Invasive species may contain toxins or be poisonous to humans and wildlife. For example, the poisonous cane toad (*Rhinella marina*) introduced to Australia has been responsible for toxic effects when ingested by pets and wildlife (Llewelyn et al., 2010).

Some of Southeast Asia's most successful invasive species are known to transmit fatal pathogens to humans, domesticated animals, and native fauna. For instance, it is known that the feral rock pigeon (*Colomba livia*), an invasive species found in many Southeast Asian towns and cities, transmits at least 40 diseases to other birds in other parts of the globe. The Red Imported Fire Ant (*Solenopsis invicta*) is aggressive and known for its painful stings. They can also damage crops, disrupt ecosystems, and impact native insect populations. The potential distribution areas of *S. invicta* were primarily concentrated in southeastern North America, large parts of South America, East and Southeast Asia, and Central Africa (Chen et al., 2020).

c. Biodiversity

The introduction of invasive species may endanger native biodiversity. Several conclusions can be drawn with reasonable assurance about the causes of the decline in native biota during biological invasions based on the available evidence. First, the superior competitive ability of successful biological colonisers is the driving force behind many of the drastic biotic changes they cause. Multiple studies in Southeast Asia have documented the advantageous life-history characteristics

of biological colonisers that enable them to outcompete native species. Due to their ability to fix nitrogen, invasive *Acacia auriculiformis* and *Acacia cincinnata* from Australia were able to colonise the disturbed heath vegetation in Brunei, displacing native pioneer species such as those belonging to the genera *Alphitonia*, *Commersonia*, *Dillenia*, *Gymnostoma*, *Macaranga*, *Melastoma*, and *Ploiarium* (Osunkoya et al., 2005). In the same heath forest, another introduced conspecific, *Acacia mangium* from agroforestry, could outcompete native plants like *Melastoma beccarianum* due to its accelerated growth under disturbed conditions (Osunkoya et al., 2005). The invasion of *Acacia nilotica* in Baluran National Park, Indonesia, has been detrimental to the savannah ecosystem. Recent evidence indicates that the tree is steadily migrating to eastern Indonesia, beginning in Bali and Kupang. This invasion has succeeded in the destruction of savannah ecosystems and biodiversity (Zahra et al., 2020).

In the absence of native predators, the species diversity of aquatic vegetation in Thailand's wetlands decreased as the density of an invasive snail (*Pomacea canaliculata*) increased (Carlsson et al., 2004). As a result of the decimation of submerged macrophytes and the resulting ecological alterations, native aquatic snails (e.g., Pila apple snails, *Pila* spp.) and other macroinvertebrates have been displaced (Global Invasive Species Database). A simple assessment of the impact of these alien plants on biodiversity revealed that 56 (82%) were regarded as minor weeds due to their limited distribution along roadsides and canal banks. Twelve (18%) were considered major weeds, widespread in natural wetlands and had an unwanted ecological, aesthetic, and economic impact on the areas they had invaded. Three species *Merremia boissiana* (Gagn.) van Ooststr., *Ipomoea eberhardtii* Gagn, and *Mimosa pigra* were identified as the species with high-ranking impacts on biodiversity and ecosystem biodiversity in Ba Na - Nui Chua Nature Reserve (BNNR) Vietnam (Thoa et al., 2021).

d. Culture

Invasive species have the potential to disrupt traditional practices, modify landscapes, and alter the cultural identity of local communities. Invasive alien species can disrupt the profoundly rooted cultural practices and knowledge systems of Southeast Asian communities. For instance, invasive plant species can invade and dominate areas where traditional medicinal plants or culturally significant plant species thrive, thereby endangering the availability of these resources for cultural practices and rituals.

Invasive species can result in the loss or deterioration of indigenous knowledge systems relating to local biodiversity. As invasive species replace or displace native flora and fauna, traditional knowledge of these species and their uses can diminish, affecting cultural heritage and intergenerational knowledge transfer. IAS can alter the visual aesthetics of natural areas, cultural sites, and sacred spaces. Visual aesthetics can affect the sense of place, spiritual connections, and cultural significance of these landscapes, thereby influencing the cultural identity and tourism potential of Southeast Asian communities.

Threats to Traditional Agriculture Invasive species can have a negative effect on traditional agricultural practices, such as shifting cultivation and agroforestry, by outcompeting native crops, depleting soil nutrients, and influencing pollinators. These disturbances can result in the loss of agricultural diversity and traditional farming practices, frequently inextricably linked to cultural heritage. To address the cultural impacts of invasive alien species in Southeast Asia, it is necessary to recognize the intrinsic relationship between biodiversity and culture and to incorporate traditional knowledge and cultural perspectives into management strategies for invasive species. Community engagement, participatory approaches, and the incorporation of local knowledge systems are essential for developing culturally sensitive and sustainable management practices.

e. Infrastructure

Invasive alien species can pose serious risks to infrastructure, such as structures, transportation systems, and utility networks. These hazards can result in economic losses, higher maintenance expenses, and disruptions to vital services. Some invasive species, including termites and wood-boring insects, can cause extensive damage to timber structures such as buildings, bridges, and utility poles. The structural integrity of infrastructure can be compromised by these invasive pests, posing safety risks and necessitating costly restorations. Invasive plant species, especially aggressive and fast-growing species, can damage infrastructure. They may enter pavement, walls, or structures through cracks, causing substantial damage. The root systems of invasive plants can also compromise the stability of underground pipelines, drainage systems, and foundations. Transportation infrastructure, such as roads, railways, and airports, can be impacted by invasive species. Along transportation corridors, excessive vegetation can reduce visibility, interfere with signalling systems, and increase the risk of accidents. Aquatic invasive species can impede waterway navigation and necessitate costly maintenance efforts. IAS can disrupt utility networks, including electrical lines, communication cables, and water distribution systems. If they come into contact with electrical infrastructure, trees and plants that grow near power lines may cause outages or pose safety hazards. Invasive species in aquatic ecosystems can obstruct water intake structures, affecting water supply and treatment processes.

f. Social and economy

Invasive alien species can impact infrastructure, such as dams, irrigation systems, and transportation networks. They can obstruct water flow, damage structures, and impede trade and transportation activities. These disruptions result in substantial economic costs, including repair and maintenance expenses, decreased efficiency, and trade barriers (Dehnen-Schmutz et al., 2007). In Southeast Asia, biological invasions could severely impact major economic sectors such as forestry in Indonesia, agriculture in Vietnam, fisheries in the Philippines, and tourism in Thailand. In the case of numerous invasive species, we can better understand the distribution for each descriptor only if more costs are described. Moreover, efforts to combat invasive species, whether through prevention, surveillance or applied control and monitoring, may fail at an underestimated monetary value due to

insufficient investments if there is a lack of information on the financial pressures invasive species exert on an economy.

1.6 Why is an ASEAN Action Plan of Invasive Alien Species Management needed?

An ASEAN Action Plan of Invasive Management is needed for several reasons:

- a. **A regional approach:** Invasive species are both a global and regional problem, and alien species invasion is an important conservation and management concern in the region. Wetland drainage, fires, pollution, invasive species, disease, and climate change are considered drivers of Southeast Asian biodiversity loss. By developing a regional action plan, ASEAN can facilitate collaboration among its member states, share knowledge and best practices, and coordinate efforts to address the invasive species threat.
- b. **Shared responsibility:** Invasive species are a shared problem that requires shared responsibility for their management. A regional action plan can help ensure that all ASEAN member states are actively addressing the issue, which can increase the effectiveness of management efforts.
- c. **Increased awareness and education:** An ASEAN Action Plan of Invasive Species Management can help raise public awareness and education about the invasive species threat. By promoting awareness and education, the plan can help engage stakeholders, increase support for management efforts, and encourage individual action to prevent the spread of invasive species.
- d. **Improved prevention and control measures:** An ASEAN Action Plan of Invasive Species Management can help identify and promote the most effective prevention and control measures for invasive species. By sharing best practices and coordinating efforts, member states can adopt more effective measures to prevent and control the spread of invasive species.
- e. **Enhanced regional biodiversity:** Invasive species pose a significant threat to regional biodiversity, and an ASEAN Action Plan of Invasive Species Management can help protect and enhance regional biodiversity. By promoting the conservation and sustainable use of natural resources, the plan can help preserve regional biodiversity for future generations.

An ASEAN Action Plan for Invasive Alien Species Management is needed to address the invasive species threat more efficiently, effectively, and sustainably. By promoting a regional approach through shared responsibility in increasing awareness and education, improving prevention and control measures, and enhancing regional biodiversity, the plan can help protect the environment and promote the well-being of ASEAN member states and their citizens.

2 Roles and responsibilities in invasive alien species management

2.1 Local communities

Local communities are encouraged to prevent their introduction and control invasive alien species (IAS) invasion. Effective IAS management requires the cooperation and collaboration of local communities and other stakeholders to address the complex social, economic, and environmental factors contributing to IAS's spread and invasion.

The role of local communities in IAS management are:

- a) Local communities contribute to raising awareness and educating other community members on the negative impact of IAS on biodiversity, ecological services, and human livelihoods.
- b) Local communities are involved in identifying, monitoring, and reporting the presence of IAS in their region and collaborating with government agencies and other stakeholders to prevent the spread of invasive species.
- c) Local communities shall be aware of the main pathway of IAS in their region and collaborate with local authorities and other stakeholders to minimise these pathways.
- d) Local communities assist the management activity by implementing control measures, such as manually or mechanically removing undesired plants or animals and rehabilitating degraded habitats or ecosystems. Local communities can contribute their knowledge and skill to the development and implementation of eradication and management programs.

2.2 National

The national government has a crucial role and obligation in managing invasive alien species. They are responsible for implementing and enforcing policies, regulations, and legislation to prevent the entrance and spread of alien invasive species within their respective domains, not only because of the national needs but also as an obligation from international conventions for biodiversity management such as CBD Global Biodiversity Framework. Among their responsibilities are the following:

- a) National governments are responsible for formulating national and regional strategies and action plans to prevent the introduction and spread of invasive alien species. These strategic or action plans may involve risk assessments, monitoring and surveillance, early detection and rapid response, and public education campaigns.
- b) Develop and execute policies to control invasive species' importation, transport, and release. This action covers restrictions regarding the trading of live animals and plants and the use of biocontrol chemicals.
- c) Perform research to detect and evaluate the threats of invasive alien species and establish appropriate management techniques.
- d) National and ASEAN countries should contribute to financing and securing funding for invasive alien species research and management programs.
- e) National and ASEAN countries should work together to identify and control invasive alien species' main pathways.

- f) Enhance coordination and collaboration between other AMS and international organisations to avoid introducing and spreading invasive alien species across international borders.
- g) National governments are responsible for proactively managing invasive alien species by preventing the introduction and spread of invasive species and developing effective management techniques to control current infestations.

2.3 Regional

Regional members of Southeast Asian States (AMS) have a significant role and duty in invasive alien species management. Among their responsibilities are the following:

- a) Improve coordination and cooperation: Effective coordination and cooperation among regional members is essential to prevent the cross-border introduction of invasive alien species. This activity comprises information sharing, coordinating control and management actions, and cooperative monitoring.
- b) Regional members are active in enhancing capacity on risk assessment, identification, control, and management, as well as the use of appropriate technology to counteract the adverse effects of invasive species.
- c) Regional members are active in strengthening the regulation/laws and policies to control invasive alien species. For example, they must build monitoring systems and control the trade and movement of invasive species.
- d) Regional members collaborate diligently in order to impart knowledge concerning the impact of invasive alien species on the environment, economy, and public health. This concerted effort encompasses the task of educating and engaging farmers, traders, and the general public.
- e) Regional members actively engage in the comprehensive study of the biology, ecology, as well as the social and economic implications of invasive alien species. This concerted effort entails the development of robust systems aimed at early detection and swift responses.
- f) Secure funding for regional work/collaborative activities on IAS Management

2.4 Research and Education

Research and education are critical in invasive alien species (IAS) management. The following are some of their responsibilities:

- a) Research implementation: enhancing comprehensive study of the biology, ecology, and effects of IAS on the environment and the economy. This research can help develop new and different ways to manage and control IAS.
- b) Creating new ways to control IAS: Encouraging the research institutions and universities to develop innovative approaches to control IAS, such as biological control, chemical control, and cultural control.
- c) Training: Encouraging the Educational institutions to develop training and education programs for IAS management professionally by offering courses on IAS management, conducting research, and promoting awareness of the importance of IAS management.

- d) Public awareness: educational institutions can help raise awareness among the public about IAS and their negative impacts on biodiversity, ecology, and human health. This awareness can help promote community participation in IAS management efforts.
- e) Sharing knowledge: Research institutions and schools can promote knowledge sharing by holding seminars, workshops, and conferences on IAS management. This activity can help share best practices, experiences, and lessons learned from different regions and countries.
- f) Collaboration with stakeholders: enhancing researchers and educational institutions to improve collaboration with stakeholders, such as government agencies, NGOs, and local communities, to help IAS management efforts. Collaboration can help develop effective policies and strategies for IAS management and implement control measures.

2.5 Stakeholders' identification related to IAS management

Identifying stakeholders is an essential step in invasive alien species management. Here are some of the stakeholders you may want to consider:

- a) Government agencies: These may include departments responsible for environmental protection, agriculture, forestry, fisheries, and wildlife management.
- b) Non-governmental organisations (NGOs): Environmental NGOs may be involved in advocacy, education, and research related to invasive alien species. Agricultural and forestry groups may also have an interest in invasive species management.
- c) Researchers and academics: Scientists who study invasive species can provide valuable information on their impacts and control measures.
- d) Landowners and land managers: People who own or manage land where invasive species are present may be directly affected by their impacts and have a role to play in their management.
- e) Indigenous communities: Invasive species can significantly impact Indigenous communities' cultural and natural resources, and their involvement in management efforts is essential.
- f) Industry and business: Businesses that rely on natural resources or tourism may be interested in invasive species management to protect their assets.
- g) Recreational users: People who enjoy outdoor activities such as hiking, hunting, and fishing may be affected by invasive species and have a role to play in their management.
- h) Local communities: Invasive species can impact the quality of life in local communities, and their involvement in management efforts can help to minimise those impacts.
- i) General public: Public awareness and support are essential for successful invasive species management efforts.

To ensure the effectiveness of our efforts to manage invasive alien species, it is critical to identify any relevant stakeholders and include them in the management process.

3 Notable past and current programmes

Removing Barriers to Invasive Species Management in Protection and Production Forests in Southeast Asia (FORIS Project), December 2012-August 2026, United Nations Environment Program (UNEP)-Global Environment Facility (GEF) funded

The FORIS project was implemented in four countries in Southeast Asia: Indonesia, Cambodia, Vietnam, and the Philippines. It was managed regionally by CABI Southeast Asia. Within countries, the project was implemented through the Environmental Ministries of the participating countries: Ministry of Environment, Cambodia, Forestry Research and Development Agency, Indonesia, the Department of Environment and Natural Environment, Philippines, and Ministry of Nature Resources and Environment, Viet Nam. The project resulted in the creation of National Coordinating Units and Technical Working Groups, the development of National Invasive Species Strategy and Action Plans (NISSAP), the development of National IAS Communication Plans and the roll-out of information and awareness campaigns in the four countries, drafting of management plans for selected priority IAS, and conduct of regional and national training programs on IAS.

Building an effective forest biosecurity network in Southeast Asia, 2021-2025, Australian Centre for International Agricultural Research (ACIAR) funded

The project will be implemented in five (5) Southeast Asian countries where ACIAR previously worked: Lao PDR, Cambodia, Indonesia, Malaysia, and Vietnam. The project aims to establish a regional forest biosecurity network to enhance preparedness and rapid response in preventing the entry of invasive forest pests and diseases in the region. It will be managed through a steering committee composed of the Australian Government's ACIAR, Department of Agriculture Water and Environment, Plant Health Australia, Plant Biosecurity Research Initiative, and Food and Agriculture Organization (FAO). The project is expected to establish a forest biosecurity network that will contribute to improved forest biosecurity engagement and improvements to forest biosecurity policy and practice, establish a pilot HRSS network, which will provide data on established target pests and enabling of rapid response, and develop standardised protocols and reporting for FHS, which will contribute to baseline information on pests in plantations and improved reporting.

Ships Ballast Water and Biofouling Treatment Systems for Marine Vessels (SAILS) Program: Port and Ballast Water Baselines Using Ecological, 2021-2023, Department of Science and Technology (DOST) through the Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD) funded.

The project is being implemented by the University of the Philippines, Bicol University, Immaculate Conception the University of Davao and co-implemented by the Philippine Coast Guard and the Maritime Industry Authority (MARINA). The SAILS Program aims to respond to the Philippines' commitment to the Ballast Water Management Convention (BWMC) and Anti-Fouling Systems Convention (AFS).

Microbiological And e-DNA Approaches (PORTEC Project) in the Philippines, 2021-2023, Department of Science and Technology (DOST) through the Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD) funded.

The PORTEC Project aims to establish inventories of marine species in Philippine ports and ballast using ecological, environmental DNA and next-generation sequencing approach. It targets ports in Manila Bay, Bicol, Cebu, and Davao ports in the Philippines. The project results will guide the Philippine Coast Guard and MARINA in crafting policies and guidelines for maritime shipping in the Philippines.

Strengthening Capacities for Prevention, Control and Management of Invasive Alien Species (SMIAS) in Indonesia, 2023, Food and Agriculture Organization of the United Nations-Global Environment Facility funded.

The executing agency is the Directorate of Biodiversity Conservation under the Ministry of Environment and Forestry, Indonesia. This new project in Indonesia aims to safeguard important biodiversity areas and ecosystem services by preventing, controlling, and managing invasive alien plant species in Indonesia. Demonstration sites will focus on two protected areas in Indonesia: Bantimurung Bulusaraung National Park (BBNP) in South Sulawesi and Bromo Tengger Semeru National Park (BTSNP) in East Java. BBNP is an ASEAN Heritage Park. The project expects to update the targets, timelines, and budget of the NISSAP, form a Biosecurity task force within the Ministry for Maritime and Investment Affairs, come up with an updated national list of priority IAS, establish invasive plant species management plans and Payment for Ecosystem Services (PES) programs for the two project landscapes.

4 International Conventions and National Framework

Convention on Biological Diversity

The Convention of Biological Diversity (CBD), to which 192 countries are signatories, has identified IAS as a priority area. It calls parties to "prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species; global priorities, guidelines, and collaboration are set" (Article 8h). During the 15th Conference of Parties, the parties agreed on the final text of the Kunming-Montreal Global Biodiversity Framework (KMGBF), which includes four goals and 23 targets to achieve by 2030. KMGBF Target 6 states to "Eliminate, minimise, reduce and or mitigate the impacts of invasive alien species on biodiversity and ecosystem services by identifying and managing pathways of the introduction of alien species, preventing the introduction and establishment of priority invasive alien species, reducing the rates of introduction and establishment of other known or potentially invasive alien species by at least 50 per cent, by 2030, eradicating or controlling invasive alien species, especially in priority sites, such as islands". These action plans are formulated to respond to KM GBF target 6, calling parties of Southeast Asia to control and mitigate the impact of IAS on biodiversity and ecosystem services.

The Cartagena Protocol on Biosafety

The Cartagena Protocol on Biosafety was adopted during the 12th Conference of Parties to the CBD which addresses the introduction of living modified organisms through the trade for aquaria, ornamental and pet industries, and as live bait and live food. It provides guidelines for the handling, transporting, and using of these LMOs created using modern biotechnology.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

The CITES recognises the threats posed by the introduction of alien species trade. Decisions 10.54, 10.76 and 10.86 adopted during the 10th Conference of Parties provided a recommendation to parties in developing national legislations and regulations in the trade of live plants and animals, consultation with the import and export countries regarding domestic measures regulating imports and building collaboration between the CITES and the CBD on the introduction of alien and potentially invasive species.

The Convention on Wetlands of International Importance (Ramsar Convention)

The Resolution VIII.18 of the Convention stipulates the convention's recognition of the threat of IAS in wetlands and urges parties to address this threat in a decisive, holistic manner, using appropriate tools and guidelines in formulating wetland-specific national strategies and priority actions. Parties are encouraged to pursue collaborative activities with organisations and Secretariats of relevant conventions.

The Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention)

The Article III4c of the CMS Convention calls Parties within the range of Appendix I listed species to "prevent, reduce or control factors that are endangering or are likely to endanger the species further, including strictly controlling the introduction of, or controlling or eliminating, already introduced exotic species". IAS is considered a threat to CMS species and has been included in the updated CMS Strategic Plan for 2015-2023 (UNEP/CMS/Resolution 10.5). The revised plan adopts Objective 2.6 of the CMS Strategic Plan for 2006—2014, which calls for actions "to mitigate the most serious threats to migratory species and obstacles to animal migration initiated or carried out, in particular relating to wind turbines, power lines, by-catch, oil pollution, climate change, disease, invasive species (within the specificities of CMS) and illegal take". Further, a report reviewing the impacts of IAS on migratory species protected under the CMS was produced for the 11th Conference of Parties. The report suggests CMS-listed species threatened by IAS and highlights the need for national implementation of MEAs to manage IAS effectively.

International Plant Protection Convention/ Asia and Pacific Plant Protection Convention (IPPC)

The IPPC deals primarily with the pest of plants in international trade to prevent the spread of potentially harmful organisms to plants and plant products. It has issued the Code of

The IPPC is recognised by the World Trade Organization as the international standard in Sanitary and Phytosanitary Measures. Regional plant protection organisations facilitate the implementation of the IPPC.

International Maritime Organization (IMO) - International Convention for the Control and Management of Ship's Ballast Water and Sediments (Ballast Water Management Convention)

The International Maritime Organization of the United Nations is responsible for ensuring the safety and security of the environment during shipping operations (Reaser, 2011). The Ballast Water Management Convention aims to prevent the environmental and health risks of transferring harmful aquatic organisms in ships' ballast, thus providing a critical framework to halt the spread of aquatic IAS through ships.

World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement)

This agreement provides governments with the measures to minimise the risk of being exposed to IAS species, pests and diseases through the movement of goods for trade and commerce. The provisions of the SPS Agreement are meant to minimise the spread of IAS through trade. It permits governments to impose measures to protect their territories against the potential entry, establishment and spread of IAS and pests.

Climate Change Treaty or the United Nations Framework Convention on Climate Change (UNFCCC)

Given the increased risks of IAS with climate change, this treaty may be crucial to IAS management. Specifically, CBD calls on governments, through the UNFCCC, to consider IAS when considering measures to adapt and mitigate climate change risks for local and indigenous communities COP 6 Decision VI/23.

United Nations Convention on the Law of the Sea (UNCLOS or Law of the Sea)

The Article 6 of Part XII on the Protection and Preservation of the Marine Environment stipulates those states "shall take all measures necessary to prevent, reduce and control pollution of the marine environment resulting from the use of technologies under their jurisdiction or control, or the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment, which may cause significant and harmful changes".

International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)

The objectives of this Treaty are the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security. Article 6 - Sustainable Use of Plant Genetic Resources, there are states that ITPGRFA promote strengthening research which enhances and conserves biological diversity by maximising intra- and inter-specific variation for the

benefit of farmers, especially those who generate and use their own varieties and apply ecological principles in maintaining soil fertility and in combating diseases, weeds and pests.

Membership of ASEAN Member States to MEAs and Organizations

ASEAN Member States have taken steps towards minimising IAS's effects on biodiversity and the environment. Specifically, countries have started to address their commitments to the CBD concerning IAS, while other countries have crafted their national action plans to combat the spread of IAS (Table 7).

Table 1 Membership of ASEAN Member States to MEAs and Organizations

Multilateral Environmental Agreements and organisations	BN	KH	ID	LA	MY	MM	PH	SG	TH	VN
Convention on Biological Diversity	X	X	X	X	X	X	X	X	X	X
Cartagena Protocol		X	X	X	X	X	X		X	X
CITES	X	X	X	X	X	X	X	X	X	X
Ramsar Convention		X	X	X	X	X	X		X	X
CMS/ Bonn Convention							X			
UNCLOS	X	X	X	X	X	X	X	X	X	X
IPCC		X	X	X	X	X	X	X	X	X
Ballast Water Convention	X	X	X		X	X	X	X	X	X
FAO	X	X	X	X	X	X	X	X	X	X
ITPGRFA		X	X	X	X	X	X		X	

ASEAN Member States have taken steps towards minimising IAS' effects on biodiversity and the environment. Specifically, countries have started to address their commitments to the CBD concerning IAS, while other countries have crafted their national action plans to combat the spread of IAS (Table 2).

The National Invasive Species Strategy and Action Plan (NISSAP) and components of IAS in the National Biodiversity Strategy and Action Plan (NBSAP) provide governments with the framework to envision a comprehensive and cross-cutting approach to managing and eradicating the spread and impacts of IAS in the country. The National Biodiversity Strategy and Action Plan respond to Article 6 of the CBD. Parties must prepare a principal instrument detailing the national strategy to conserve biodiversity and the measures to achieve these targets. The NISSAP responds to COP 6 Decision VI/23, whereby Parties reaffirm the importance of national and regional invasive alien species action plans.

Table 2 National Action Plans on IAS Management

Country	NISSAP	IAS Integration in NBSAP
Brunei Darussalam		National Biological Resources (Biodiversity) Policy and Strategic Plan of Action (2015) Essential activity includes formulating a National Action Plan for invasive aquatic species in Brunei Darussalam, which falls under the immediate and medium-term timeline.

Country	NISSAP	IAS Integration in NBSAP
Cambodia	X	<p>Cambodia National Biodiversity Targets (2015-2020)</p> <p>Target 18 (Aichi Target 9): By 2020, major invasive alien species (IAS) and their pathways have been identified and prioritised and prioritised IAS and pathways are controlled.</p> <p>Targets related to IAS:</p> <p>Target 10 (Aichi Target 12): By 2020, all species of fauna and flora threatened at the national level have been identified. Their status has been improved significantly because of applying measures to address their respective threats.</p> <p>Target 12 (Aichi Target 5): By 2020, the loss rate of natural forests, coral reefs, and other natural habitats will be at least halved, and habitat degradation and fragmentation, pollution, overharvesting, the introduction of invasive alien species and their impacts are significantly reduced.</p>
Indonesia	X	<p>Indonesia National Biodiversity Targets (2015-2020)</p> <p>Target 9 (Aichi Target 9): Implementing prevention and eradication programs for invasive alien species (JAI).</p> <p>Targets related to IAS:</p> <p>Target 12 (Aichi Target 12): Realisation of efforts to maintain the populations of endangered species as a national conservation priority.</p> <p>Target 14 (Aichi Target 14): Improved functionality of integrated ecosystems to ensure the improvement of essential services (water, health, livelihoods, tourism).</p>
Lao PDR		<p>Lao National Biodiversity Target (2016-2025)</p> <p>Sub-strategy 1.5: Protected Areas Management and Species Conservation</p> <p>Target 1.5.5: Improved regulations are enforced, and capacities are improved to protect plants (including rice) and animals in priority areas from alien species invasion.</p>
Malaysia	X	<p>Malaysia Biodiversity Targets (2016-2025)</p> <p>Goal 3: We have safeguarded all our key ecosystems, species, and genetic diversity</p> <p>Target 11: By 2025, invasive alien species and pathways will be identified, priority species controlled, and measures will be implemented to prevent their introduction and establishment.</p> <p>Targets related to IAS:</p> <p>Target 9: By 2025, the extinction of known threatened species has been prevented, and their conservation status has been improved and sustained.</p>
Myanmar		<p>Myanmar Biodiversity Targets (2015-2020)</p> <p>Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use.</p> <p>Target 9.1: By 2019, NIASP will have been developed and approved and is under active implementation with the support of civil society, local communities, the private sector, and the international community.</p>
Philippines	X	<p>Philippines Biodiversity Targets (2015-2028)</p> <p>Target 9: Target 9: By 2020, invasive alien species and pathways will be identified and prioritised, priority species will be controlled or eradicated, and measures will be in place to manage paths to prevent their introduction and establishment.</p>
Singapore		<p>Singapore Biodiversity Targets (2011-2020)</p> <p>National Target 7: By 2020, a potentially invasive alien species list for Singapore will be compiled.</p>

Country	NISSAP	IAS Integration in NBSAP
Thailand		Thailand Biodiversity Targets (2015-2021) Strategy 2 Conserve and restore biodiversity Measure 3 Reduce threats to biodiversity and habitats <ul style="list-style-type: none"> Measure 3.7 Push for implementing the Measures for Protection, Control and Eradication of Invasive Alien Species according to the Cabinet Resolution of 28 April 2009. Measure 6: Management of invasive alien species <ul style="list-style-type: none"> By 2016: Invasive alien species in each ecosystem and major pathways are identified, and inventories are in place. By 2020: Measures for managing priority invasive alien species and major pathways are in place.
Vietnam	X	Vietnam Biodiversity Targets (2020-2030) Program 3.1.4. Control activities that have negative impacts on biodiversity c) Control, halt and prevent the damage caused by invasive alien species and enhance biosafety management of genetically modified organisms

Sources: 6th National Reports to the CBD <https://www.cbd.int/reports/>; Latest NBSAPs submitted to the CBD <https://www.cbd.int/nbsap/about/latest/>

5 Strategic Goals, Objective, and Action Plan for Invasive Alien Species Management 2023 – 2030

5.1 Strategic Goal

The ASEAN invasive species action plan aims to reduce the negative impacts of invasive species on the environment, economy, and society of the ASEAN member states. The action plan aims to achieve this goal through a coordinated, strategic, and sustainable approach to invasive species management.

Within the goal, emphasis is to be placed on the following:

- 1) **Strengthen legal frameworks and coordination:** The action plan aims to strengthen legal frameworks for invasive species management, including regulatory frameworks for importing and exporting living organisms.
- 2) **Enhance public awareness and education:** The action plan aims to increase public awareness and education about the invasive species threat and promote individual action to prevent the spread of invasive species.
- 3) **Increase capacity and resources:** The action plan aims to increase the capacity and resources available for invasive species management, including funding, personnel, and technical expertise.
- 4) **Risk assessment and prioritisation:** The action plan emphasises the importance of assessing the risks posed by invasive species and prioritising management efforts accordingly. This action includes developing risk assessment tools and frameworks and identifying priority species and pathways of introduction.
- 5) **Maintaining strong border control and developing an inter-island biosecurity programme:** Invasive species can enter a country through multiple pathways, including legal and illegal trade, transport intentionally or unintentionally from people activities. The action plan takes a holistic approach to plants, animals, pathogens and

other organisms that are non-native to an ecosystem and potentially become invasive. From the action plan, AMS can maintain activities beyond border control, such as pre-border risk assessments, early detection and rapid response, command and control, capacity building and stakeholder engagement, and international cooperation.

The biosecurity programme or *biosecurity* is considered as one of the goals as it is a strategic and integrated concept that encompasses the policy and regulatory frameworks (including instruments and activities) that analyse and manage risk in food safety, public health, animal life and health, and plant life and health, including associated environmental risk (FAO, 2007). Biosecurity, within the context of invasive species management, refers to a set of practices and measures designed to prevent the introduction, establishment, spread, and impact of invasive species on ecosystems including marine and aquatic ecosystems, agriculture, human health, and other elements of the environment. It involves a combination of proactive and reactive strategies aimed at minimizing the risks posed by non-native species that can negatively impact native flora, fauna, and ecosystems.

- 6) **Improved prevention and control measures:** The action plan can assist in identifying and promoting the most effective prevention and control measures for invasive species. Recovering the native species populations and restoring ecosystems following invasive alien species management.
- 7) **Monitoring, Evaluation and Reporting:** Regular monitoring and evaluation of local habitats and reporting of sightings of invasive alien species can help identify and control their pathways.
- 8) **Ensure Sustainable Financing for IAS Management:** it is important to identify the needs of the IAS management in each ASEAN member country, key challenges, opportunities and the resources required to address them. Sustainable financing for IAS management at national level should involve all relevant stakeholders, including governments, NGOs, academics, and the private sector. This can help ensure that the mechanism is inclusive and considers different stakeholders' diverse needs and perspectives.

5.2 Objectives and Action Plans

GOAL 1: STRENGTHEN LEGAL FRAMEWORKS AND COORDINATION

Objective 1.1:

Strengthen legislation, policy framework, and protocols to underpin the effective management of invasive alien species.

Action Plan:

- Harmonisation of invasive species legislation, regulations or protocols are consolidated and rationalised to improve IS management effectiveness
- Harmonisation of the operational manual and other policies/procedures for biosecurity
- Identify efficient mechanisms to enhance enforcement of policies and collaborate with enforcement agencies to eradicate and control invasive alien species

Objective 1.2:

Strengthen cooperation and coordination at the national, regional, and international level..

Action Plan:

- Promote a regional/national Invasive Species Coordinator
- Promote a Technical Advisory Group with members from government departments (TAG)
- Identify and strengthen existing mechanisms for cooperation at national level
- Provide and coordinate training workshops/programs to increase capacity building

GOAL 2: IMPROVE PUBLIC AWARENESS AND EDUCATION

Objective 2.1:

Enhance awareness of invasive alien species impacts and management.

Action Plan:

- Assess the public understanding of invasive alien species, their impacts and management
- Enhance the involvement of citizen sciences in invasive species surveys and monitoring
- Establish a network of stakeholders, including government agencies, NGOs, and private sector organisations, to support awareness-raising and capacity-building

Objective 2.1:

Develop an educational program on invasive alien species impacts and management.

Action Plan:

- Develop and disseminate education programs on invasive alien species, their impacts and management, including the use of multimedia platforms
- Develop educational materials such as brochures, posters, and videos that explain the impacts of invasive alien species and how to prevent their spread.

GOAL 3: INCREASE CAPACITY AND RESOURCES

Objective 3.1:

Mobilise and maintain knowledge of alien and invasive alien species.

Action Plan:

- Enhance a web-based information resource for invasive species to share information on species ecology, distribution, pathways of introduction and spread, management, impacts on native species, ecosystems and services

- Promote partnerships with universities, research institutions and other organisations that can provide support on capacity building

Objective 3.2:

Enhance skills and techniques to manage invasive alien species.

Action Plan:

- Provide and coordinate training workshop/programs to increase capacity building
- Develop technology and data management tools to enhance surveillance and monitoring efforts (remote sensing, mapping, and data analysis)
- Promote the use of traditional knowledge in invasive alien species research and management

GOAL 4: RISK ASSESSMENT AND PRIORITISATION

Objective 4.1:

Develop effective systems of invasive alien species risk assessment.

Action Plan:

- Harmonisation of the risk assessment tools
- Harmonisation of the Tool for invasive species prioritisation

Objective 4.2:

Identify priority invasive alien species.

Action Plan:

- Enhance a prioritisation process to identify priority species for management based on magnitude of impacts, (including potential impacts) and feasibility of management
- Develop the list of priority species including management goals (i.e. eradication, control)
- Develop and implement invasive species management plans for priority sites

Objective 4.3:

Develop the management of priority invasive alien species.

Action Plan:

- Enhancing the biology, ecology and control methods of priority invasive species to support effective management
- Develop standard operational procedures to eradicate or control priority invasive alien species

GOAL 5: MAINTAINING STRONG BORDER CONTROL AND DEVELOPING AN INTER-ISLAND BIOSECURITY PROGRAMME

Objective 5.1:

Strengthen biosecurity to prevent the introduction of species across the border.

Action Plan:

- Improve the screening methods to prevent the introduction of invasive species
- Utilise the pathway analysis (for present pathways) and identify priority pathways
- Develop and improve early detection biosurveillance capability, field knowledge, tools, techniques, and technologies, including molecular approaches.
- Inform rapid response actions to recent introductions by EDRR, including using streamlined geospatial mapping and data from authoritative databases

Objective 5.2:

Establish and maintain an early detection and rapid response mechanism.

Action Plan:

- Carry out surveys with standardised methodologies (SOP) to update the national checklist of alien and invasive species (terrestrial, freshwater and marine biomes)
- Carry out monitoring for high-risk taxa, high-risk species at high-risk areas to detect new incursions
- Develop a detailed generic emergency response plan for new incursions (should include process for confirming species identification, decision making, resourcing (e.g. skilled staff, equipment and financial means)
- Encourage rapid response actions to recent introductions by EDRR, including using streamlined geospatial mapping and data from authoritative databases

GOAL 6: IMPROVED PREVENTION AND CONTROL MEASURES

Objective 6.1:

Improve capacity building to control and management of invasive alien species.

Action Plan:

- Develop and implement pathway management plans for priority pathways
- Conduct Cost and benefit analysis of controlling the invasive alien species
- Enhance the capacity to control invasive species using a biological agent

Objective 6.2:

Ecosystem restoration and native species population recovery followed by invasive alien species management.

Action Plan:

- Design and implement restoration projects to control invasive alien species invasions in priority ecosystems.

GOAL 7: IMPROVED MONITORING, EVALUATION AND REPORTING SYSTEM**Objective 7.1:**

Develop a robust monitoring, evaluation and reporting mechanism to share information and update progress on IAS management and control across ASEAN country members.

Action Plan:

- Enhance monitoring, evaluation, and reporting standards and protocols for invasive species management
- Promote data sharing and collaboration at the regional and national levels

Objective 7.2:

Strengthen capacity for monitoring, evaluation and reporting

Action Plan:

- Strengthen capacity for monitoring and reporting
- Implement regular monitoring and evaluation program (regional and national)

GOAL 8: SUSTAINABLE FINANCING FOR IAS MANAGEMENT**Objective 8.1:**

Mobilise funding from various sources, including national and regional governments, international organisations, private sector, and civil society.

Action Plan:***National and regional governments:***

- Advocating for IAS management to be included in national and regional policies, plans, and budgets.
- Explore partnerships with development partners and the private sector to leverage funding and resources.
- Encouraging national and regional governments to allocate funding to IAS management through dedicated funding mechanisms, such as grants, and subsidies.

Private sector:

- Encourage the private sector to allocate funding to IAS management through dedicated corporate social responsibility programs and initiatives.

- Encourage partnerships with the national and regional agencies to support initiatives on IAS management
- Advocating for IAS management to be included in industry standards, certifications, and reporting frameworks.

Objective 8.2:

Ensure the sustainability of funding for IAS management, including long-term planning, monitoring, and evaluation of funding allocation and effectiveness.

Action Plan:

- Ensure sustainable funding that considers estimated costs for IAS management activities such as prevention, early detection, and rapid response, over several years.
- Improve adaptive management approaches to adjust IAS management activities based on the results of monitoring and evaluation.
- Engage stakeholders, such as local communities, non-governmental organisations, and government agencies, in the planning and implementing IAS management activities.

6 Monitoring, Evaluation and Reporting

Monitoring and evaluation are essential tools for controlling the spread of invasive alien species. Beside the monitoring and evaluation, reporting is also important to trace and update efforts in managing IAS. Controlling the spread of invasive alien species is an important task for maintaining ecosystem health and biodiversity.

To improve the monitoring, evaluation, and reporting system for this purpose, we could consider the following steps:

- **Develop a clear monitoring and evaluation plan:** It's important to have a clear monitoring and evaluation plan in invasive alien species management. This will help ensure that monitoring and evaluation efforts are focused, efficient, and effective.
- **The use of recent technology:** There are many technological tools available to help with monitoring and evaluation, including satellite imagery, drones, and GPS tracking. These tools can help identify and track invasive alien species in real-time, making it easier to respond quickly to new infestations.
- **Develop a comprehensive inventory:** Develop an inventory of all invasive alien species present in the area. The inventory should include the species name, description, habitat, and the extent of the species' spread.
- **Involve local communities:** Local communities are often the first to notice the presence of invasive alien species. Engaging them in monitoring and evaluation efforts can help to identify new infestations early and act before they spread.
- **Establish a monitoring and surveillance system:** Establish a monitoring and surveillance system to track the spread of invasive species. This system should include regular surveys, inspections, and monitoring of the habitats where invasive

species are known to occur. Use a variety of monitoring tools such as remote sensing, data analysis, and on-ground inspections.

- Establish early detection and rapid response: Early detection and rapid response are critical for controlling the spread of invasive alien species. Early detection increases the chances of eradicating or controlling the invasive species before it becomes established. Once detected, rapid response teams should be deployed to eradicate or control the invasive species.
- Set up a reporting system: Set up a reporting system to facilitate communication and information sharing among stakeholders. This system should be designed to report invasive species sightings, monitoring data, and other relevant information. The system should also allow for the tracking of control and eradication efforts.
- Evaluate and adapt: Evaluate the effectiveness of the monitoring, evaluation, and reporting system on a regular basis. Based on the findings, adapt the system to improve its effectiveness. Continuously review and update the inventory, monitoring system, and reporting system to ensure that they are responsive to changing conditions.

7 Sustainable Financing for IAS Management Across ASEAN Countries

Developing and ensuring a sustainable financing for IAS management involves various steps and considerations as IAS can cause significant harm to ecosystems, human health, and the economy. Managing these species requires a sustained effort and financing to support these efforts. This financing for managing invasive alien species can be created through mobilisation of resources and/or leveraging from various sources including from development partners. Some of the proposed process to mobilise financing/resources at national level are:

- Conduct a needs assessment: The conduct of needs assessment will provide information on the needs, key challenges, and opportunities across ASEAN countries and determine the resource requirements to address concerns on IAS management.
- Ensuring sustainable financing: Once the needs have been identified, it is important to ensure sustainable financing to support the IAS management initiatives. This may involve leveraging existing sources of funding or creating new ones, such as a dedicated fund or grant programs.
- Develop financial resources management systems: Effective financial management systems are essential for ensuring that the funds are used efficiently and effectively. This includes developing budgeting, accounting, and reporting systems that are transparent, accountable, and aligned with the priorities of the IAS management initiatives.
- Ensure stakeholder engagement: To sustain financing for IAS management all relevant stakeholders must be involved, thus, the meaningful involvement of the governments, NGOs, academics, and the private sector are encouraged. This is to ensure inclusivity and consider the diverse needs and perspectives of different stakeholders.
- Monitor and evaluate: Ongoing monitoring and evaluation are critical to ensure that the financing will meet its objectives and deliver the intended results. The M&E may

include establishing performance indicators and benchmarks, and conduct of regular reviews and assessments to identify areas for improvement.

- Consider regional cooperation: Given the transboundary nature of IAS, regional cooperation among ASEAN countries can help enhance the effectiveness and sustainability of the actions and financing. This may involve sharing best practices, coordinating funding initiatives, and establishing regional platforms for knowledge exchange and capacity building.

Managing invasive alien species requires a combination of funding sources and innovative and sustainable financing. It is possible to create a sustained effort to manage invasive species and safeguard ecosystems, human health, and the economy by utilising a variety of funding sources and innovative financing. There are opportunities to secure funding for IAS administration from international and regional sources.

There are international funding examples for IAS management such as:

- Global Environment Facility (GEF): The GEF provides grants to support initiatives that address global environmental issues, such as the management of invasive species. Using the GEF's biodiversity focus area, invasive species-related projects can be funded.
- United Nations Development Programme (UNDP): The UNDP provides funding and technical assistance for initiatives relating to sustainable development, such as invasive species management. They may assist various funding mechanisms, such as the Small Grants Program of the Global Environment Facility.
- International organisations such as the World Bank, the Asian Development Bank (ADB), and the Food and Agriculture Organization (FAO) also provide financial and technical support for invasive species management initiatives in Southeast Asia.

Some potential options to generate funding from IAS management, among them:

- Government funding: Governments can allocate funds to manage invasive species through their budgetary processes. This can be through dedicated funding streams or through funding earmarked for environmental conservation. This funding can be used to support research, monitoring, and management activities.
- Private sector funding: Private sector organisations can support invasive species management through corporate social responsibility initiatives, philanthropy, or payments for ecosystem services. These funding sources can be leveraged to support research, monitoring, and management efforts.
- User fees: User fees can be used to fund invasive species management activities. These fees can be levied on industries that are likely to spread invasive species, such as the shipping industry, or on activities that increase the risk of introducing invasive species, such as recreational boating.
- Bonds: Bonds can be used to finance invasive species management efforts. These bonds can be issued by governments or private sector organisations and can be used to fund research, monitoring, and management activities.
- Green finance mechanisms: Innovative financing mechanisms such as green bonds, carbon credits, and environmental impact bonds can be used to finance invasive species management efforts. These mechanisms provide financial incentives for

managing invasive species and can be used to mobilise private sector funding for conservation activities.

In conclusion, rigorous planning, stakeholder participation, ongoing monitoring, and assessment are needed to build ensure sustainable financing for IAS management. By taking a collaborative and inclusive approach, ASEAN countries can enhance their capacity to address the challenges posed by IAS and protect their unique biodiversity and ecosystems.

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9 Annexes

9.1 Annex 1: Major invasive species in ASEAN Country

AMS Country	Habitat	Species
Brunei Darussalam	Terrestrial Plant	<ol style="list-style-type: none"> 1. <i>Acacia mangium</i> 2. <i>Acacia Auriculiformis</i> 3. <i>Echinochloa crus-galli</i> 4. <i>Rottboellia cochinchinensis</i>
	Aquatic Plant	<ol style="list-style-type: none"> 1. <i>Eichornia crassipes</i> 2. <i>Mimosa pigra</i>
	Terrestrial Fauna	<ol style="list-style-type: none"> 1. <i>Spodoptera exigua</i> 2. <i>Chromatomyia horticola</i>
	Fresh Water	<ol style="list-style-type: none"> 1. <i>Pomacea canaliculata</i> 2. <i>Pomacea insularum</i> 3. <i>Clarias gariepinus</i> 4. <i>Piaractus brachypomus</i> 5. <i>Cyprinus carpio</i> 6. <i>Ctenopharyngodon Idella</i> 7. <i>Monopterus albus</i> 8. <i>Hypophthalmichthys nobilis</i>
	Marine	<ol style="list-style-type: none"> 1. <i>Lutjanus kasmira</i>
Cambodia	Terrestrial Plant	<ol style="list-style-type: none"> 1. <i>Chromolaena odorata</i> 2. <i>Ludwigia hyssopifolia</i> 3. <i>Jatropha curcas</i> 4. <i>Mimosa invisa</i>
	Aquatic Plant	<ol style="list-style-type: none"> 1. <i>Mimosa pigra</i> 2. <i>Eichornia crassipes</i> 3. <i>Pistia stratiotes</i>
	Terrestrial Fauna	<ol style="list-style-type: none"> 1. <i>Rattus rattus</i> 2. <i>Apis mellifera (insect)</i>
	Fresh Water	<ol style="list-style-type: none"> 1. <i>Pomacea canaliculate</i> 2. <i>Arapaima gigas</i> 3. <i>Piaractus brachypomus</i> 4. <i>Crocodylus rhombifer</i> 5. <i>Trachemys scripta elegans</i> 6. <i>Rana catesbiana</i> 7. <i>Procambarus clarkii</i>
	Marine	<ol style="list-style-type: none"> 1. <i>Anguilla japonica</i>
Indonesia	Terrestrial Plant	<ol style="list-style-type: none"> 1. <i>Acacia nilotica</i> 2. <i>Chromolaena odorata</i> 3. <i>Austroephorium inolifolium</i> 4. <i>Mikania micrantha</i> 5. <i>Spathodea campanulate</i> 6. <i>Merremia peltate</i> 7. <i>Piper aduncum</i> 8. <i>Bidens pilosa</i>

AMS Country	Habitat	Species
	Aquatic Plant	1. <i>Eichornia crassipes</i> 2. <i>Salvinia molesta</i> 3. <i>Hydrilla verticillate</i> 4. <i>Mimosa pigra</i> 5. <i>Pistia stratiotes</i>
	Terrestrial Fauna	1. <i>Bemisia tabaci (insect)</i> 2. <i>Brontispa longissima (insect)</i> 3. <i>Corvus splendens (bird)</i>
	Fresh Water	1. <i>Salvinia molesta</i> 2. <i>Oreochromis mossambicus</i> 3. <i>Oreochromis niloticus</i> 4. <i>Aristichthys nobilis</i> 5. <i>Cyprinus carpio (fish)</i> 6. <i>Oncorhynchus mykiss (fish)</i> 7. <i>Arapamia gigas</i> 8. <i>Pomacea canaliculata</i>
	Marine	1. <i>Colomesus Psittacus</i> 2. <i>Plectrochilus wieneri</i>
Lao PDR	Terrestrial Plant	1. <i>Echinochloa colonum</i> 2. <i>Echinochloa crusgalli</i> 3. <i>Mimosa invisa</i>
	Aquatic Plant	1. <i>Mimosa pigra</i> 2. <i>Eichornia crassipes</i>
	Terrestrial Fauna	1. <i>Hyblaea puera</i> 2. <i>Eutectona machaeralis</i>
	Fresh Water	1. <i>Pomacea canaliculata</i> 2. <i>Oreochromis spp.</i>
	Marine	No information
Malaysia	Terrestrial Plant	1. <i>Acacia mangium</i> 2. <i>Alternanthera philoxeroides</i> 3. <i>Mikania micrantha</i> 4. <i>Ageratina Adenophora</i> 5. <i>Rottboellia cochinchinensis</i> 6. <i>Parthenium hysterophorus</i> 7. <i>Leucaena leucocephala</i>
	Aquatic Plant	1. <i>Mimosa pigra</i> 2. <i>Salvinia molesta</i>
	Terrestrial Fauna	1. <i>Rattus norvegicus</i> 2. <i>Rhinella marina</i> 3. <i>Pelodiscus sinensis</i>
	Fresh Water	1. <i>Clarias gariepinus</i> 2. <i>Oreochromis mossambicus</i> 3. <i>Oreochromis niloticus</i> 4. <i>Cherax quadricarinatus</i>

AMS Country	Habitat	Species
	Marine	<ol style="list-style-type: none"> 1. <i>Amathia distans</i> 2. <i>Mytella charruana</i> 3. <i>Cochlodinium polykrikoides</i> 4. <i>Gymnodinium catenatum</i> 5. <i>Crassostrea gigas</i>
Myanmar	Terrestrial Plant	<ol style="list-style-type: none"> 1. <i>Mimosa diplotricha</i> 2. <i>Prosopis juliflora</i> 3. <i>Acacia auriculiformis</i> 4. <i>Leucaena leucocephala</i> 5. <i>Lantana camara</i> 6. <i>Casuarina equisetifolia</i> 7. <i>Chromolaena odorata</i> 8. <i>Mikania micrantha</i> 9. <i>Paspalum conjugatum</i> 10. <i>Imperata cylindrica</i> 11. <i>Echinochloa crus-galli</i> 12. <i>Pennisetum sp.</i>
	Aquatic Plant	<ol style="list-style-type: none"> 1. <i>Eichornia crassipes</i> 2. <i>Pistia startiotes</i>
	Terrestrial Fauna	<ol style="list-style-type: none"> 1. <i>Achatina fulica</i>
	Fresh Water	<ol style="list-style-type: none"> 1. <i>Pomacea canaliculata</i> 2. <i>Osteoglossiformes spp</i> 3. <i>Clarias gariepinus</i> 4. <i>Cyprinus carpio</i> 5. <i>Ctenopharyng odon Idella</i> 6. <i>Oreochromis spp.</i>
	Marine	<ol style="list-style-type: none"> 1. <i>Teredo spp.</i>
Philippines	Terrestrial Plant	<ol style="list-style-type: none"> 1. <i>Chromolaena odorata</i> 2. <i>Lantana camara</i> 3. <i>Piper aduncum</i> 4. <i>Spathodea campunalata</i> 5. <i>Leucaena leucocephala</i> 6. <i>Mikania micrantha</i>
	Aquatic Plant	<ol style="list-style-type: none"> 1. <i>Eichornia crassipes</i> 2. <i>Salvinia molesta</i>
	Terrestrial Fauna	<ol style="list-style-type: none"> 1. <i>Hylarana erythraea</i> 2. <i>Rattus tanezumi</i> 3. <i>Rhinella marina</i> 4. <i>Hoplobatrachus rugulosus</i> 5. <i>Eleutherodactylus planirostris</i> 6. <i>Trachemys scripta elegans</i> 7. <i>Pelodiscus sinensis</i> 8. <i>Rattus exulans</i> 9. <i>Callosciurus finlaysonii</i> 10. <i>Monomorium floricola (insect)</i>
	Fresh Water	<ol style="list-style-type: none"> 1. <i>Pomacea canaliculata</i>

AMS Country	Habitat	Species
		2. <i>Cyprinus carpio</i> 3. <i>Gambusia affinis</i> 4. <i>Oreochromis niloticus</i> 5. <i>Parachromis managuensis</i> 6. <i>Pterygoplichthys</i> spp.
	Marine	1. <i>Carcharhinus falciformis</i>
Singapore	Terrestrial Plant	1. <i>Clidemia hirta</i> 2. <i>Dioscorea sansibarensis</i> 3. <i>Acacia auriculiformis</i> 4. <i>Cecropia pachystachya</i> 5. <i>Falcataria moluccana</i> 6. <i>Leucaena leucocephala</i> 7. <i>Manihot carthaginensis</i> subsp. <i>Glaziovii</i> 8. <i>Muntingia calabura</i> 9. <i>Piper aduncum</i> 10. <i>Pipturus argenteus</i> 11. <i>Spathodea campanulata</i>
	Aquatic Plant	1. <i>Eichhornia crassipes</i> 2. <i>Salvinia molesta</i>
	Terrestrial Fauna	1. <i>Acridotheres javanicus</i> 2. <i>Achatina fulica</i>
	Fresh Water	1. <i>Pomacea canaliculata</i> 2. <i>Trechemys scripta elegans</i> 3. <i>Macrobrachium lanchesteri</i> 4. <i>Oreochromis mossambicus</i> 5. <i>Rana catesbeiana</i>
	Marine	1. <i>Mytella strigata</i> 2. <i>Mytilopsis sallei</i>
Thailand	Terrestrial Plant	1. <i>Imperata cylindrica</i> 2. <i>Mikania micrantha</i> 3. <i>Chromolaena odorata</i> 4. <i>Pennisetum</i> spp. 5. <i>Prosopis juliflora</i> 6. <i>Ageratina adenophora</i>
	Aquatic Plant	1. <i>Eichhornia crassipes</i> 2. <i>Mimosa pigra</i> 3. <i>Salvinia molesta</i>
	Terrestrial Fauna	1. <i>Achatina fulica</i> 2. <i>Rattus norvegicus</i> 3. <i>Brontispa tabaci</i> (insect)
	Fresh Water	1. <i>Pomacea canaliculata</i> 2. <i>Hypostomus Plecostomus</i> 3. <i>Pterygoplichthys pardalis</i> 4. <i>Pomacea</i> spp. 5. <i>Sarotherodon melanotheron</i> 6. <i>Trachemys scripta elegans</i>

AMS Country	Habitat	Species
	Marine	1. <i>Mytilopsis sallei</i> 2. <i>Mytella strigata</i>
Vietnam	Terrestrial Plant	1. <i>Cinnamomum camphora</i> (tree) 2. <i>Lantana camara</i> 3. <i>Urochloa maxima</i> (grass) 4. <i>Panicum repens</i> (grass)
	Aquatic Plant	1. <i>Eichhornia crassipes</i> 2. <i>Mimosa pigra</i>
	Terrestrial Fauna	1. <i>Tenebrio molitor</i> 2. <i>Ophiphagus hannah</i> 3. <i>Myocastor coypus</i> 4. <i>Pomacea canaliculata</i> (mollusc) 5. <i>Myocastor coypus</i>
	Fresh Water	1. <i>Gambusia affinis</i> (fish)
	Marine	No information

9.2 Annex 2. Detail Action plan and Activities

Goal 1: Strengthen legal frameworks and coordination

Objective 1.1 Strengthen legislation, policy framework, and protocols to underpin the effective management of invasive alien species					
Actions	Activities	Indicators	Lead Agency	Timeline	Financing
1.1. Harmonisation of invasive species legislation, regulations or protocols are consolidated and rationalised to improve IAS management effectiveness	<ul style="list-style-type: none"> - Conduct a review of existing invasive species legislation, regulations, and protocols at the national, regional, and international levels. - Identify gaps, inconsistencies, and overlaps in the current legal frameworks. 	<ul style="list-style-type: none"> - The number of countries or jurisdictions that adopt and implement harmonised legislation, regulations, or protocols for invasive species management. - The reduction in overlaps, gaps, and inconsistencies in invasive species legislation and regulations as a result of the harmonisation process. 			
1.2. Harmonisation of the operational manual and other policies/procedures for biosecurity	<ul style="list-style-type: none"> - Conduct a comprehensive review of extant national, regional, or organisational biosecurity policies, procedures, and operational manuals. - Establish a working group or task force of relevant stakeholders, including government agencies, biosecurity experts, industry representatives, and relevant organisations. 	<ul style="list-style-type: none"> - The number of jurisdictions, organisations, or relevant parties that adopt and implement harmonised biosecurity policies and procedures. - As a result of the harmonisation efforts, there is improved coordination and collaboration between relevant biosecurity stakeholders. - The successful implementation of the 			

Objective 1.1 Strengthen legislation, policy framework, and protocols to underpin the effective management of invasive alien species

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<ul style="list-style-type: none"> - Develop a strategic plan delineating the steps, deadlines, and parties responsible for harmonising the operational manual and other biosecurity policies and procedures. 	<p>harmonised policies and procedures results in practices for biosecurity that are efficient and effective.</p>			
<p>1.3. Identify efficient mechanisms to enhance enforcement of policies, and collaborate with enforcement agencies to eradicate and control invasive alien species</p>	<ul style="list-style-type: none"> - Conduct a thorough review of the existing enforcement mechanisms for invasive alien species (IAS). - Evaluate the effectiveness, strengths, weaknesses, and enhancement opportunities of the enforcement mechanisms. - Identify shortcomings and obstacles in the enforcement of IAS-related policies. - Evaluate the appropriateness and enforceability of extant IAS-related laws, regulations, and policies. 	<ul style="list-style-type: none"> - Increase the quantity of successful IAS-related enforcement actions. - Reduction in the number of IAS populations that are uncontrolled or proliferating. - Existing laws, regulations, or policies are updated or revised to address deficiencies and enhance their enforceability. - Successful legal actions or prosecutions regarding IAS violations. 			

Objective 1.2 Strengthen cooperation and coordination at the national, regional and international level

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
<p>1.4. Promote a Regional/National Invasive Species Coordinator is needed</p>	<ul style="list-style-type: none"> - Develop a framework or strategy for coordinating the management of invasive species. - Determine the specific duties, objectives, and responsibilities of the regional or national coordinator for invasive species. - Identify prospective funding sources to support the creation and operation of the position of regional or national coordinator for invasive species. - Engage with relevant government agencies, international organisations, or donor agencies in order to obtain financial and technical support. 	<ul style="list-style-type: none"> - Evidence of improved coordination and collaboration among relevant invasive species management stakeholders - Evidence of the coordinator's participation in policy formulation and implementation coordination - Establishment of systems to collect, manage, and analyse data on the occurrences, impacts, and control efforts of invasive species - The number of effective eradication or control programs implemented with the assistance of the regional or national invasive species coordinator. 			
<p>1.5. Promote a Technical Advisory Group with members from</p>	<ul style="list-style-type: none"> - Recognize the significance of expert advice and technical guidance to effectively 	<ul style="list-style-type: none"> - Active participation of TAG members in meetings, consultations, and knowledge-sharing activities. 			

Objective 1.2 Strengthen cooperation and coordination at the national, regional and international level

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
government departments (TAG)	address invasive species challenges. - Determine the TAG's specific goals, roles, and responsibilities. - Provide formal terms of reference document, specify the TAG's mandate, operation, and operating procedures. - Schedule regular meetings for the TAG to deliberate and provide technical advice on strategies, policies, and initiatives for the management of invasive species.	- Level of engagement and contribution of TAG members in addressing invasive species challenges. - Evidence of the TAG's contributions to informed decision-making processes related to invasive species management - Number of collaborative initiatives or joint projects facilitated by the TAG. - Number of knowledge-sharing events, workshops, or capacity-building activities organised by the TAG.			
1.6. Identify and strengthen existing mechanisms for cooperation at national level	- Conduct a comprehensive evaluation of existing national mechanisms, platforms, and networks for cooperation in invasive species management. - Establish formal or informal frameworks for collaboration, such as memorandums of understanding, partnership agreements, and joint action plans.	- Evidence of enhanced collaboration among invasive species management stakeholders - Quantity of financial and technical resources mobilised for the management of invasive species. - Number and extent of active participation of stakeholders in collaborative initiatives.			

Objective 1.2 Strengthen cooperation and coordination at the national, regional and international level

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<ul style="list-style-type: none"> - Enhance institutional connections and coordination mechanisms among government departments, agencies, and organisations involved in the management of invasive species. 				
<p>1.7. Provide and coordinate training workshops/programs to increase capacity building</p>	<ul style="list-style-type: none"> - Develop a comprehensive training program that addresses the identification, monitoring, prevention, and management of invasive species. - Develop and deliver training materials in collaboration with invasive species management specialists, researchers, and practitioners. - Present case studies, best practices, and successful examples of invasive species management from various regions or countries. - Encourage networking and collaboration among participants in order to build a community of 	<ul style="list-style-type: none"> - Evaluate the participants' prior and post-training knowledge and abilities. - Evaluate the development in their understanding and competence regarding the management of invasive species. - Determine the extent to which participants have implemented the acquired knowledge and abilities. - Observe the implementation of best practices and recommended methods learned during training. - Evaluate the incorporation of new techniques or strategies into the invasive species management practices of participants. - Evaluate the impact of capacity-building activities on 			

Objective 1.2 Strengthen cooperation and coordination at the national, regional and international level

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	invasive species management practitioners who are supportive of one another. - Conduct evaluations and capture participant feedback to determine the effectiveness of training programs.	the management of invasive species.			

Goal 2: Improve public awareness and education

Objective 2.1 Enhance awareness of invasive alien species impacts and management.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
2.1. Assess public understanding of invasive alien species, their impacts and management	- Create surveys or questionnaires to assess the public's knowledge and cognizance of invasive alien species. - Analyse media coverage, including news articles, online journals, and social media discussions, to determine the public's understanding and perception of invasive species.	- Percentage of the public that is aware of the concept of invasive alien species. - Knowledge about specific invasive species and their impacts on ecosystems, economies, and human health - Public perceptions of the severity and urgency of the invasive species problem - Identification of specific knowledge gaps or misconceptions about invasive species			

Objective 2.1 Enhance awareness of invasive alien species impacts and management.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<ul style="list-style-type: none"> - Evaluate the efficacy of existing educational materials, campaigns, and outreach activities in enhancing public awareness of invasive species. - Track public inquiries and complaints regarding invasive species in order to identify prevalent misunderstandings, concerns, and knowledge gaps. - Engage with diverse stakeholders, including community groups, non-governmental organisations, and educational institutions, to comprehend their perceptions and knowledge of invasive species. - Conduct studies or surveys on the public's knowledge of invasive species in collaboration with academic institutions and researchers. 	<ul style="list-style-type: none"> - Level of engagement and participation in invasive species management initiatives, such as reporting sightings, adopting best practices, or supporting policies. - Evaluation of the effectiveness of educational materials, campaigns, and outreach activities in increasing public understanding - Trends in public discourse related to invasive species management 			

Objective 2.1 Enhance awareness of invasive alien species impacts and management.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
<p>2.2. Involvement of citizen sciences in invasive species surveys and monitoring</p>	<ul style="list-style-type: none"> - Create educational materials, such as brochures, online resources, or videos, to educate citizen scientists about invasive species, their identification, impacts, and monitoring methods. - Conduct training sessions or workshops to equip them with the necessary skills and knowledge to identify invasive species and collect data accurately. - Develop field guides or mobile applications that citizen scientists can use for species identification in the field. - Create a standardised protocol for citizen scientists to follow when collecting data on invasive species. - Create an online platform or mobile application where citizen scientists can submit their observations and data. - Develop a system for quality control and data 	<ul style="list-style-type: none"> - The number of citizen scientists who have been trained in invasive species identification and monitoring methods - The number of invasive species observations and data submitted by citizen scientists - The accuracy and reliability of citizen-collected data through validation and quality control processes - The participation and engagement of citizen scientists in community events, workshops, or online forums - The impact of citizen scientist-collected data on invasive species management efforts, such as the identification of new species, early detection, or targeted control actions - Gather feedback from citizen scientists on their experience, satisfaction, and perceived value of their involvement in invasive species surveys and monitoring. 			

Objective 2.1 Enhance awareness of invasive alien species impacts and management.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<p>validation to ensure the accuracy and reliability of the collected information.</p> <ul style="list-style-type: none"> - Organise community events, workshops, or meetings to foster engagement and collaboration among citizen scientists. - Recognize and acknowledge the contributions of citizen scientists through certificates, badges, or public appreciation events. 				
<p>2.3. Establish a network of stakeholders, including government agencies, NGOs, and private sector organisations, to support awareness-raising and capacity-building</p>	<ul style="list-style-type: none"> - Identify relevant government agencies, non-governmental organisations (NGOs), organisations from the private sector, and other stakeholders involved in the management of invasive alien species. - Develop a communication strategy to facilitate the sharing of information and collaboration between stakeholders. - Create educational materials, hold seminars, 	<ul style="list-style-type: none"> - Number and diversity of network participants, including government agencies, non-governmental organisations, private sector organisations, and community groups. - Count of collaborative initiatives, projects, or activities undertaken by network participants. - Count of collaboratively planned capacity-building activities. - Evaluate the participation and contentment of stakeholders 			

Objective 2.1 Enhance awareness of invasive alien species impacts and management.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<p>or organise public events to increase public awareness of the negative effects of invasive species and the significance of their management.</p> <ul style="list-style-type: none"> - Identify stakeholders' capacity-building requirements and develop training programs or workshops to address those needs. - Organise knowledge-sharing events, workshops, or conferences where stakeholders can share best practices, lessons learned, and success tales relating to the management of invasive alien species. - Facilitate the development of collaborative projects or initiatives to address common invasive species management challenges among stakeholders. 	<p>in training programs and seminars.</p> <ul style="list-style-type: none"> - Obtain funding, grants, and in-kind donations from stakeholders to support invasive species management initiatives. 			

Objective 2.2 Develop an educational program on invasive alien species impacts and management.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
<p>2.4. Develop and disseminate education programs on invasive alien species, their impacts and management, including the use of multimedia platforms</p>	<ul style="list-style-type: none"> - Develop educational curricula or lesson plans on invasive alien species for different age groups, from primary schools to universities. - Collaborate with schools, colleges, and universities to integrate invasive species education into existing curricula. 	<ul style="list-style-type: none"> - Assess the increase in knowledge and understanding of invasive species among participants through pre- and post-program assessments or surveys. - Monitor the integration of invasive species education into formal education curricula at different levels, from primary schools to universities. - The number of educational institutions that incorporate invasive species content into their courses 			
<p>2.5. Develop educational materials such as brochures, posters, and videos that explain the impacts of invasive alien species and how to prevent their spread.</p>	<ul style="list-style-type: none"> - Identify key messages and information to be included in the educational materials. - Design visually appealing brochures, posters, and videos that effectively convey the impacts of invasive species and prevention strategies. - Incorporate visuals, infographics, and diagrams to illustrate the impacts and spread of invasive species. 	<ul style="list-style-type: none"> - The number of educational materials distributed or made available to the target audience - The reach and accessibility of the materials, such as the number of downloads, views, or physical distribution locations. - Gather feedback from users of the educational materials through surveys or feedback forms. - Increase in knowledge and understanding of invasive species and prevention strategies among the target audience. 			

Objective 2.2 Develop an educational program on invasive alien species impacts and management.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<ul style="list-style-type: none"> - Develop educational materials that cater to specific audiences, such as homeowners, gardeners, farmers, or recreational users. - Highlight practical prevention strategies, such as early detection, proper waste management, and responsible trade practices. - Ensure that the educational materials are user-friendly and accessible to a wide range of individuals. - Develop a distribution plan to reach the target audience effectively. 	<ul style="list-style-type: none"> - Changes in behaviour or adoption of preventive measures among the target audience. - The effectiveness of visuals and interactive elements in capturing and retaining audience attention 			

Goal 3: Increase capacity and resources

Objective 3.1 Mobilise and maintain knowledge of alien and invasive alien species.					
Actions	Activities	Indicators	Lead Agency	Timeline	Financing
3.1. Enhance a web-based information resource for invasive species to share information on species ecology, distribution, pathways of introduction and spread, management, impacts on native species, ecosystems and services	<ul style="list-style-type: none"> - Collect and compile comprehensive data and information on invasive species, including their ecology, distribution, pathways of introduction and spread, management strategies, and impacts on native species, ecosystems, and services. - Design and develop a user-friendly and accessible website platform to host the invasive species information resource. - Create informative and engaging content, including species profiles, management guidelines, best practices, and success stories. - Regularly update the website with new information, research findings, and emerging invasive species issues. - Incorporate interactive mapping tools to display 	<ul style="list-style-type: none"> - The number of visits, page views, and unique users accessing the website - The time spent on the website and the depth of engagement with the information resource - User satisfaction through surveys or feedback forms. - The reach and impact of the web-based resource by monitoring its utilisation by key stakeholders, such as researchers, land managers, and policymakers. - User engagement metrics, such as the number of comments, submissions, or interactions with the website's interactive features 			

Objective 3.1 Mobilise and maintain knowledge of alien and invasive alien species.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<p>the distribution and spread of invasive species.</p> <ul style="list-style-type: none"> - Utilise visualisations, such as charts, graphs, and infographics, to enhance understanding of invasive species impacts and trends. - Utilise social media, newsletters, and targeted outreach activities to promote the availability and benefits of the information resource. 				
<p>3.2. Promote partnerships with universities, research institutions and other organisations that can provide support on capacity building</p>	<ul style="list-style-type: none"> - Identify universities, research institutions, and other organisations that have expertise and resources in invasive alien species management. - Define the scope of the collaboration, including specific capacity-building activities and expected outcomes. - Collaboratively design capacity-building programs, workshops, and training sessions that address the needs and 	<ul style="list-style-type: none"> - The number of partnerships established with universities, research institutions, and other organisations for capacity-building initiatives - The effectiveness of the partnership in meeting the identified capacity-building needs and addressing gaps - The level of collaboration in joint projects, research initiatives, and knowledge exchange activities - The long-term sustainability of the partnerships by assessing the continuation of collaborative 			

Objective 3.1 Mobilise and maintain knowledge of alien and invasive alien species.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<p>priorities of stakeholders involved in invasive species management.</p> <ul style="list-style-type: none"> - Organise joint training workshops, seminars, or conferences on invasive species management, inviting experts from partner organisations as speakers or trainers. - Focus on building practical skills, sharing best practices, and promoting knowledge exchange among participants. 	<p>activities beyond the initial capacity-building programs.</p> <ul style="list-style-type: none"> - The commitment of partner organisations to maintaining and expanding the collaboration over time 			

Objective 3.2 Enhance skills and techniques to manage invasive alien species.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
<p>3.3. Provide and coordinate training workshop/programs to increase capacity building</p>	<ul style="list-style-type: none"> - Develop a comprehensive curriculum for training workshops and programs that covers key aspects of invasive species management, including identification, monitoring, prevention, control, and policy frameworks. Include both theoretical knowledge and 	<ul style="list-style-type: none"> - The level of engagement, active participation, and interaction during the training sessions - The improvement in participants' skills, such as identification, monitoring, and control techniques. 			

Objective 3.2 Enhance skills and techniques to manage invasive alien species.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<p>practical skills training, incorporating case studies and best practices.</p> <ul style="list-style-type: none"> - Facilitate networking opportunities among participants, trainers, and experts to foster collaboration and knowledge exchange. - Implement pre- and post-training assessments to measure participants' knowledge gain and skill development. 	<ul style="list-style-type: none"> - The extent to which participants continue to engage with each other and share experiences and resources after the training 			
<p>3.4. Develop technology and data management tools to enhance surveillance and monitoring efforts (remote sensing, mapping, and data analysis)</p>	<ul style="list-style-type: none"> - Evaluate existing surveillance and monitoring methods for invasive alien species. - Identify gaps and challenges in data collection, analysis, and reporting. - Develop or customise technology tools and data management systems tailored to the specific needs of invasive alien species surveillance and monitoring. This may include remote sensing platforms, satellite imagery analysis tools, geographic information systems (GIS), and data visualisation software. 	<ul style="list-style-type: none"> - The number of users or stakeholders adopting and utilising the developed technology tools and data management systems - the frequency and extent of their use in invasive alien species surveillance and monitoring activities - The quality, completeness, and standardisation of the collected data following the established protocols and guidelines - The effectiveness and usability of the data visualisation tools and 			

Objective 3.2 Enhance skills and techniques to manage invasive alien species.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<ul style="list-style-type: none"> - Integrate remote sensing data, such as satellite imagery, aerial photography, and drone surveys, to map and monitor invasive alien species distribution, spread, and impacts. - Provide training programs and workshops to build the capacity of stakeholders to use technology tools and data management systems for invasive species surveillance and monitoring. - Conduct pilot studies to test the effectiveness and reliability of the technology tools and data management systems. 	<ul style="list-style-type: none"> dashboards in conveying information on invasive alien species presence, distribution, and impacts - The increase in skills and knowledge in using technology tools and data management systems through pre- and post-training assessments. 			
<p>3.5. Promote the use of traditional knowledge in invasive alien species research and management</p>	<ul style="list-style-type: none"> - Promote the recognition of traditional knowledge as a legitimate and valuable source of information and insights. - Engage indigenous and local communities, traditional practitioners, and knowledge holders in invasive alien species research and management initiatives. - Incorporate traditional knowledge into research methodologies, data collection 	<ul style="list-style-type: none"> - The number of collaborations and partnerships established between traditional knowledge holders and researchers and practitioners - The number of documented instances of traditional knowledge related to invasive alien species, including the type 			

Objective 3.2 Enhance skills and techniques to manage invasive alien species.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<p>techniques, and invasive species management strategies.</p> <ul style="list-style-type: none"> - Collaboratively develop research projects and management plans that integrate traditional and scientific knowledge systems. - Provide training and capacity-building programs for researchers, practitioners, and traditional knowledge holders on the value, ethics, and methodologies for incorporating traditional knowledge in invasive species research and management. - Ensure that the collection and use of traditional knowledge respect cultural protocols, traditional values, and ethical guidelines. 	<p>and scope of knowledge recorded</p> <ul style="list-style-type: none"> - The extent to which traditional knowledge is integrated into research methodologies, data collection techniques, and invasive species management strategies - The knowledge gained and skills developed by participants in incorporating traditional knowledge - the implementation of mechanisms to ensure respect and reciprocity in knowledge sharing 			

Goal 4: Risk assessment and prioritisation

Objective 4.1 Develop effective systems of invasive alien species risk assessment					
Actions	Activities	Indicators	Lead Agency	Timeline	Financing
4.1. Harmonisation of the risk assessment tools	<ul style="list-style-type: none"> - Conduct a comprehensive review of existing risk assessment tools used for invasive alien species. - Identify similarities, differences, and gaps in the methodologies, criteria, and parameters used in these tools. - Develop a set of harmonised criteria and parameters for the risk assessment of invasive alien species. Consider factors such as species characteristics, pathways of introduction, potential impacts, and the feasibility of management. - Provide training programs and workshops to build the capacity of stakeholders to use the harmonised risk assessment tools. 	<ul style="list-style-type: none"> - The adoption and utilisation of the harmonised risk assessment tools by relevant stakeholders - The integration of the harmonised risk assessment tools into policy frameworks, guidelines, and management strategies 			
4.2. Harmonisation of the Tool for invasive species prioritisation	<ul style="list-style-type: none"> - Conduct a thorough review of the existing tools used for invasive alien species prioritisation. 	<ul style="list-style-type: none"> - The number of organisations, agencies, or countries using the tool to inform their invasive 			

Objective 4.1 Develop effective systems of invasive alien species risk assessment

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<ul style="list-style-type: none"> - Identify the common elements, methodologies, and criteria used in these tools. - Develop a set of harmonised criteria and parameters for invasive alien species prioritisation. Consider factors such as potential impacts, likelihood of establishment and spread, invasiveness, and feasibility of control or eradication. - Provide training programs and workshops to build the capacity of stakeholders to use the harmonised prioritisation tool. 	<ul style="list-style-type: none"> species management decisions - The integration of the harmonised prioritisation tool into policy frameworks, guidelines, and management strategies - The knowledge and skills development of stakeholders through capacity-building programs using the harmonised prioritisation tool 			

Objective 4.2 Identify priority invasive alien species.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
4.3. Enhance a prioritisation process to identify priority species for management based on magnitude of impacts, (including	<ul style="list-style-type: none"> - Develop a set of criteria for prioritisation, considering the magnitude of impacts (both current and potential) caused by invasive species and the feasibility of management interventions. 	<ul style="list-style-type: none"> - The adoption and use of the enhanced prioritisation process in decision-making processes related to invasive species management 			

Objective 4.2 Identify priority invasive alien species.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
potential impacts) and feasibility of management	<ul style="list-style-type: none"> - Develop a scoring system or ranking mechanism to assess and compare invasive species based on the defined criteria. 				
4.4. Develop the list of priority species including management goals	<ul style="list-style-type: none"> - Utilise the established criteria to rank and prioritise invasive alien species. - Consider their effects on native species, ecosystems, agriculture, human health, and the economy. - Establish distinct management objectives for each priority species. 	<ul style="list-style-type: none"> - The ranking and prioritisation of invasive species based on the defined criteria - The alignment of the selected species with their impacts and the overall management goals - The integration of the priority species list and management goals into regional or national invasive species management strategies 			
4.5. Develop and implement invasive species management plans for priority sites	<ul style="list-style-type: none"> - Conduct a thorough assessment of priority sites to identify invasive species present, their impacts, and the level of threat they pose. - Prioritise sites based on factors such as ecological sensitivity, economic importance, and feasibility of management. - Conduct baseline surveys to gather information on invasive species distribution, abundance, and impacts on 	<ul style="list-style-type: none"> - The development and adoption of site-specific invasive species management plans for priority sites - The implementation of planned management actions at priority sites - The quality and availability of monitoring data on invasive species populations, native species responses, and ecosystem health 			

Objective 4.2 Identify priority invasive alien species.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	native species and ecosystems. - Establish monitoring protocols to track changes in invasive species populations and assess the effectiveness of management interventions.				

Objective 4.3 Develop the research and management of priority invasive alien species.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
4.6. Enhancing the biology, ecology and control methods of priority invasive species to support effective management	- Conduct in-depth research on the biology, ecology, and behaviour of priority invasive species. - Assess the ecological, economic, and social impacts caused by priority invasive species. - Develop effective control methods specific to each priority invasive species. - Enhance prevention strategies and early detection systems to reduce the introduction and establishment of priority invasive species. - Encourage the adoption of integrated pest management	- The number and quality of scientific publications, reports, and studies related to priority invasive species - The adoption and utilisation of improved control methods developed for priority invasive species - The integration of integrated pest management approaches into invasive species management strategies			

Objective 4.3 Develop the research and management of priority invasive alien species.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<p>approaches that combine multiple control methods.</p> <ul style="list-style-type: none"> - Develop standardised monitoring protocols to track the distribution, abundance, and impact of priority invasive species. 				
<p>4.7. Develop standard operational procedures to eradicate or control priority invasive alien species</p>	<ul style="list-style-type: none"> - Develop standard operational procedures (SOPs) detailing step-by-step guidelines for implementing the identified eradication or control techniques. Include instructions on equipment, materials, timing, and safety precautions to ensure consistency and replicability. - Continuously monitor and evaluate the effectiveness of the applied control techniques in eradicating or reducing the target invasive species populations. 	<ul style="list-style-type: none"> - The progress in developing standardised operational procedures for eradicating or controlling the target invasive species - The accessibility and availability of the SOPs to relevant stakeholders 			

Goal 5: Maintaining strong border control and developing an inter-island biosecurity programme

Objective 5.1 Strengthen biosecurity to prevent the introduction of species across the border.					
Actions	Activities	Indicators	Lead Agency	Timeline	Financing
5.1. Improving screening methods to prevent the introduction of invasive species	<ul style="list-style-type: none"> - Assess the effectiveness and limitations of existing screening methods used to prevent the introduction of invasive species. - Strengthen inspection and quarantine procedures at ports, airports, and border checkpoints to prevent the accidental introduction of invasive species through trade, travel, or transportation. 	<ul style="list-style-type: none"> - The effectiveness of the enhanced screening methods in preventing the accidental or intentional introduction of invasive species 			
5.2. Utilising pathway analysis (for present pathways) and identify priority pathways	<ul style="list-style-type: none"> - Identify and analyse current pathways through which invasive alien species are introduced, transported, or spread. - Identify emerging pathways of potential concern for invasive species introduction (global trade trends, transportation developments, emerging markets, and other factors that may create new pathways). - Design and implement targeted interventions and management strategies for high-priority pathways. 	<ul style="list-style-type: none"> - The identification and documentation of known pathways through which invasive alien species are introduced or spread - The implementation of targeted interventions and management strategies for high-priority pathways 			

Objective 5.1 Strengthen biosecurity to prevent the introduction of species across the border.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
<p>5.3. Develop and improve early detection biosurveillance capability, field knowledge, tools, techniques, and technologies, including molecular approaches.</p>	<ul style="list-style-type: none"> - Explore and adopt advanced technologies such as DNA barcoding, molecular diagnostics, remote sensing, and data analytics to improve screening methods. - Develop and utilise portable field screening devices or apps to aid in rapid species identification. - Explore advancements in molecular biology, genetics, remote sensing, and other relevant fields to enhance screening capabilities. 	<ul style="list-style-type: none"> - The adoption and implementation of improved screening methods and technologies 			
<p>5.4. Inform rapid response actions to recent introductions by EDRR, including using streamlined geospatial mapping and data from authoritative databases</p>	<ul style="list-style-type: none"> - Develop a framework or network that facilitates coordination and communication among relevant stakeholders involved in EDRR efforts. - Establish standardised protocols and guidelines for data collection, reporting, and sharing among stakeholders involved in EDRR. - Strengthen surveillance and monitoring programs to enable early detection of newly introduced invasive species. 	<ul style="list-style-type: none"> - The effectiveness of rapid response actions in containing and eradicating recently introduced invasive species - The availability and accessibility of geospatial mapping data and information from authoritative databases 			

Objective 5.1 Strengthen biosecurity to prevent the introduction of species across the border.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<ul style="list-style-type: none"> - Utilise geospatial mapping technologies and tools to accurately map the distribution and extent of recent introductions. 				

Objective 5.2 Establish and maintain an early detection and rapid response mechanism.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
5.5. Carry out surveys with standardised methodologies (SOP) to update the national checklist of alien and invasive species (terrestrial, freshwater and marine biomes)	<ul style="list-style-type: none"> - Harmonisation of standardised methodologies and protocols for conducting surveys of alien and invasive species in terrestrial, freshwater, and marine biomes - Define survey parameters, sampling techniques, data collection methods, and data recording formats. - Establish a centralised database or information management system to store and manage survey data. 	<ul style="list-style-type: none"> - The accuracy of species identification and verification processes - The number of newly recorded alien and invasive species added to the national checklist - The completeness and quality of data collected during surveys 			
5.6. Carry out monitoring for high-risk taxa, high-risk species at high-risk areas	<ul style="list-style-type: none"> - Conduct a risk assessment to determine which taxa and species pose the greatest invasion risk. Assess factors such as biological characteristics, routes of 	<ul style="list-style-type: none"> - The frequency and coverage of monitoring surveys conducted in high-risk areas 			

Objective 5.2 Establish and maintain an early detection and rapid response mechanism.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
to detect new incursions	introduction, and potential impacts on native ecosystems. - Determine which areas are susceptible to invasion or have a history of invasion. Identify areas with high habitat suitability, high human-mediated disturbance, or native species that are vulnerable.	- Changes in the abundance or distribution of high-risk taxa or species over time - The success rate of management actions in containing or eradicating newly detected invasive species			
5.7. Develop a detailed generic emergency response plan for new incursions of invasive alien species (should include process for confirming species identification, decision making, resourcing (e.g. skilled staff, equipment and financial means))	- Assess the potential impacts of new incursions of invasive alien species on ecosystems, native species, and socio-economic factors. - Determine response priorities based on the risk assessment and the potential impacts of the invasive species. - Define specific actions, such as containment, eradication, or control measures, based on the biology and characteristics of the invasive species.	- The implementation of response strategies and specific actions outlined			
5.8. Encourage rapid response actions to recent introductions by EDRR, including using streamlined	- Develop a network of trained personnel, including scientists, land managers, and citizen scientists, to actively monitor and report potential	- The efficiency and effectiveness of response protocols and decision-making processes in guiding rapid response actions			

Objective 5.2 Establish and maintain an early detection and rapid response mechanism.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
<p>geospatial mapping and data from authoritative databases</p>	<p>introductions of invasive alien species.</p> <ul style="list-style-type: none"> - Establish streamlined data collection and reporting mechanisms to facilitate the rapid flow of information regarding potential introductions. - Integrate data from multiple sources, including surveillance efforts, citizen science initiatives, and authoritative databases. - Develop response protocols and decision-making processes that outline the steps to be taken upon the detection of a recent introduction. - Utilise geospatial mapping techniques to identify and map areas at high risk of recent introductions of invasive alien species. 	<ul style="list-style-type: none"> - The success rate of rapid response actions, such as containment, eradication, or control measures, in preventing the establishment and spread of recent introductions 			

Goal 6: Improved prevention and control measures

Objective 6.1 Improve capacity building to control and eradicate invasive alien species.					
Actions	Activities	Indicators	Lead Agency	Timeline	Financing
6.1. Develop and implement pathway management plans for priority pathways	<ul style="list-style-type: none"> - Formulate management strategies specific to each priority pathway to prevent or mitigate the introduction and spread of invasive alien species. - Identify appropriate measures and interventions for each pathway, considering factors such as regulations, inspection procedures, and targeted awareness campaigns. 	<ul style="list-style-type: none"> - Reduction in pathway-related introductions: The number of new introductions or spreads of invasive alien species through priority pathways before and after the implementation of management plans 			
6.2. Cost and benefit analysis of controlling the invasive alien species	<ul style="list-style-type: none"> - Identify and quantify the direct and indirect costs associated with controlling the invasive alien species. - Analyse the economic impacts of the invasive alien species on affected ecosystems, industries, and local communities. - Assess the impacts of invasive alien species on ecosystem services such as water quality, pollination, soil health, and biodiversity. - Quantify the economic value of these ecosystem services and estimate the potential benefits of controlling the invasive species. 	<ul style="list-style-type: none"> - Implementation of cost and benefit analysis in invasive alien species management 			

Objective 6.1 Improve capacity building to control and eradicate invasive alien species.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<ul style="list-style-type: none"> - Analyse the costs associated with various control options, including prevention, early detection and rapid response, eradication, and long-term management. - Estimate the potential benefits of controlling the invasive alien species, including avoided damages, cost savings, and ecosystem restoration. - Quantify and compare the costs and benefits of controlling the invasive alien species. - Use cost-benefit analysis techniques, such as net present value (NPV), benefit-cost ratio (BCR), and internal rate of return (IRR), to evaluate the economic feasibility of control measures. 				
<p>6.3. Enhancing the capacity to control invasive species using a biological agent</p>	<ul style="list-style-type: none"> - Conduct research and surveys to identify potential biological agents, such as predators, parasites, or pathogens, that can effectively control the target invasive species. - Assess the risks associated with the introduction and use of biological agents for invasive species control. - Develop or update regulatory frameworks and guidelines for the evaluation, approval, and release of 	<ul style="list-style-type: none"> - The successful establishment and persistence of the introduced biological agent in the target invasive species' population - The decrease in the population size or impact of the target invasive species 			

Objective 6.1 Improve capacity building to control and eradicate invasive alien species.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
	<p>biological agents for invasive species control.</p> <ul style="list-style-type: none"> - Conduct laboratory and field trials to evaluate the efficacy and safety of the selected biological agents in controlling the target invasive species and their impact on non-target species. - Develop protocols for mass rearing and production of the selected biological agents to ensure a sustainable supply. - Provide training programs and workshops for personnel involved in the use and application of biological agents for invasive species control. - Implement monitoring and evaluation systems to assess the effectiveness of the biological agents in controlling the target invasive species. 	<p>following the application of biological agents</p>			

Objective 6.2 Ecosystem restoration and native species population recovery followed by invasive alien species management.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
6.4. Design and implement restoration projects to control invasive alien species invasions in priority ecosystems.	<ul style="list-style-type: none"> - Link up with the ASEAN Green Initiatives (AGI) to implement pilot restoration activities to recover native species - Undertake IAS economic valuation in ASEAN 				

Goal 7: Improved Monitoring, Evaluation and Reporting System

Objective 7.1 Develop a robust monitoring, evaluation and reporting mechanism to share information and update progress on IAS management and control across ASEAN country members.					
Actions	Activities	Indicators	Lead Agency	Timeline	Financing
7.1. Enhance monitoring, evaluation, and reporting standards and protocols for invasive species management	<ul style="list-style-type: none"> - Establish a standardised protocol for monitoring invasive alien species and their impacts. - Define key indicators, sampling methods, and data collection procedures to ensure consistency and comparability across different locations and species. 	<ul style="list-style-type: none"> - A standardised protocol for monitoring invasive alien species and their impacts. 			
7.2. Promote data sharing and collaboration at the regional and national levels	<ul style="list-style-type: none"> - Promote data sharing and collaboration among relevant agencies, organisations, and institutions involved in invasive species management at regional and national levels. - Facilitate the exchange of data, best practices, and lessons learned to enhance the effectiveness of monitoring and reporting efforts. 	<ul style="list-style-type: none"> - Data sharing at regional and national levels. 			

Objective 7.2 Strengthen capacity for monitoring, evaluation and reporting					
Actions	Activities	Indicators	Lead Agency	Timeline	Financing
7.3. Strengthen capacity for monitoring and reporting	<ul style="list-style-type: none"> - Provide training and capacity-building programs to enhance the skills and knowledge of personnel involved in invasive species monitoring and reporting. - Enhance collaboration and knowledge sharing among practitioners, researchers, and stakeholders to improve monitoring and reporting practices. 	<ul style="list-style-type: none"> - Training program - The improvement of monitoring and reporting practices 			
7.4. Implement regular monitoring and evaluation program (regional and national)	<ul style="list-style-type: none"> - Design and implement regular monitoring programs to assess the status and trends of invasive alien species populations and their impacts on ecosystems and native species. - Define reporting requirements, formats, and timelines to ensure timely and comprehensive reporting from relevant stakeholders. 	<ul style="list-style-type: none"> - Regular monitoring, evaluation and reporting on invasive alien species management 			

Goal 8: Sustainable Financing for IAS Management

Objective 8.1 Mobilise funding from various sources, including national and regional governments, international organisations, the private sector, and civil society.					
Actions	Activities	Indicators	Lead Agency	Timeline	Financing
<p>8.1. National and regional governments:</p> <ul style="list-style-type: none"> - Advocating for IAS management to be included in national and regional policies, plans, and budgets. - Explore partnerships with development partners and the private sector to leverage funding and resources. - Encouraging national and regional governments to allocate funding to IAS management through dedicated funding sources, such as grants, and subsidies. 					
<p>8.2. Private sector:</p> <ul style="list-style-type: none"> - Encourage the private sector to allocate funding to IAS management through dedicated corporate social responsibility programs and initiatives. - Encourage partnerships with private sector companies to leverage funding and resources. - Advocating for IAS management to be included in industry standards, certifications, and reporting frameworks. 					

Objective 8.2 Ensure the sustainability of funding for IAS management, including long-term planning, monitoring, and evaluation of funding allocation and effectiveness.

Actions	Activities	Indicators	Lead Agency	Timeline	Financing
8.3. Promote long-term funding plans that outline the expected costs of IAS management activities, such as prevention, early detection, and rapid response, over several years.					
8.4. Improve adaptive management approaches to adjust IAS management activities based on the results of monitoring and evaluation.					
8.5. Engage stakeholders, such as local communities, non-governmental organisations, and government agencies, in the planning and implementing IAS management activities.					

