4. Identification of Valued Environmental Components and Existing Drivers of Change

4.1 Identification of Valued Environmental Components

Identification of valued environmental components (VECs) for this study commenced with a long list of environmental and social attributes typically relevant to hydropower development (in alphabetical order): air and noise, affected people and resettlement, cultural and ethnic archaeology and heritage, erosion and sedimentation processes, fish and aquatic habitats, natural resource–dependent livelihoods such as agriculture and forestry, terrestrial habitats (for example, protected areas and critical habitats), as well as water quality and quantity. Initial stakeholder concerns are listed in Table 1.2 (Chapter 1). Final VECs (Table 4.1) were selected based on stakeholder feedback combined with scientific research and professional judgment to estimate the appropriate scope of VECs and to analyze the limits of acceptable change.

4.2 Stressors and Drivers of Change that Affect Valued Environmental Components

4.2.1 Cause-and-Effect Chain

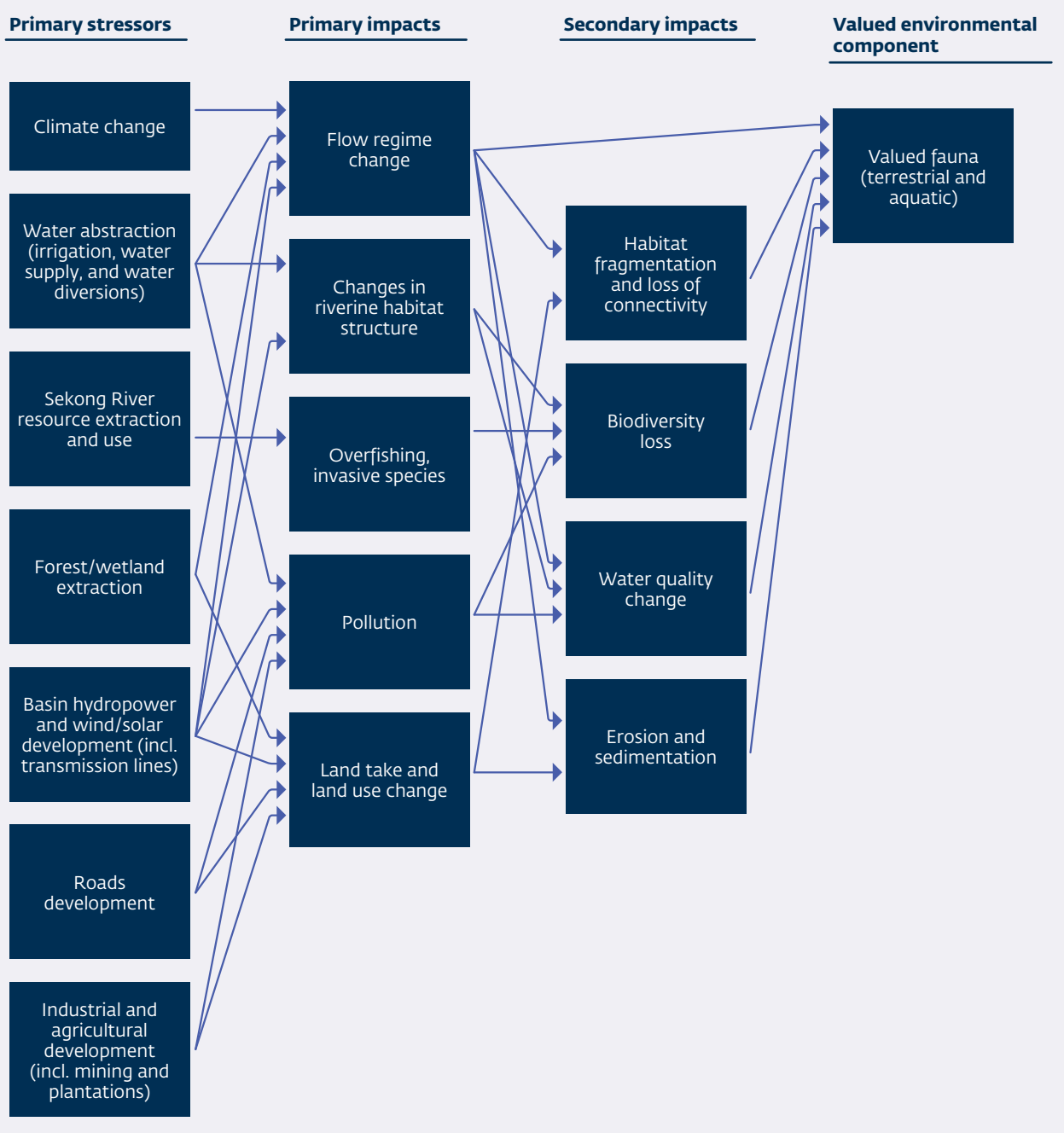
A cumulative impact assessment (CIA) is a process of analyzing potential impacts on and risks to VECs resulting from existing and proposed projects in the context of human activities and natural environmental and social external drivers over time.

The complex relationships and interactions among primary stressors, primary effects, and secondary effects that lead to cumulative impacts on VECs are illustrated in Figure 4.1. Similar cause-and-effect-impact models were developed for each VEC assessed.

Table 4.1: Selected Valued Environmental Components

Component	Description
Aquatic biodiversity and ecosystems	• Threatened or endangered aquatic habitats, flora, and fauna • Super-endemic fish (found only in the Sekong Basin) and migratory species
Terrestrial biodiversity and ecosystems	• Habitats important for biodiversity and ecosystem functions • Designated protected areas and conservation sites • Endangered and critically endangered terrestrial species
Natural resource–dependent livelihoods	• Habitats, flora, and fauna (terrestrial, riparian, and wetland) important for rural livelihoods and food security • Timber resources, including wood for construction, firewood, and charcoal • Non-timber forest products of value for food security, medicine, construction, and trade • Capture fisheries in the Sekong mainstream and tributaries • Wet-rice agriculture on river flood plains, upland fields, and dry season riverbank gardens
Community and culture	• Cohesive communities • Linguistic and cultural diversity, traditional knowledge, and ethnic identity • Gender roles and opportunities

Figure 4.1: Cause-and-Effect Chain for Cumulative Impacts on Valued Aquatic and Terrestrial Fauna



4.2.2 Anthropogenic (Human-Induced) Stressors

Human activities within the geographic boundaries covered in the CIA can be summarized as follows:

- All large and medium-sized hydropower projects, irrigation, and water supply dams along the Sekong mainstream and tributaries
- Large- and medium-scale wind and solar power generation projects in the basin
- Associated supplementary infrastructure (for example, transmission lines and roads)
- Industrial and agricultural development, including mining and plantations that will cumulatively affect VECs
- Water extraction (irrigation, water supply, and water diversions)
- River resource use (fish, sand, and gravel)
- Forest and wetlands resource use

4.2.3 Natural System Stressors

Increasing climate change will affect the hydrological regime of the Sekong Basin. There are predictions of a slight increase in flow during the wet season but a larger decrease in the dry season (Appendix B).

4.2.4 Primary and Secondary Impacts

This study has focused on the following primary and secondary impacts:

- Flow regime (hydrological) change (changes in magnitude and frequency of high and low flows)
- Changes in sediment transport (tons per year)
- Inundation, land acquisition, and change in land use (amount and percentage change in hectares)
- Overfishing and introduction of invasive species (qualitative estimate)
- Pollution and water quality change (qualitative estimate)

4.3 Impact Rating System

Determination of indicators and limits of acceptable change is a complex, multifaceted exercise. The CIA involves analysis of multiple processes of change that differ in type, scale, and other attributes. This makes it challenging to design appropriate indicators to evaluate the significance of cumulative effects on VECs.

This challenge is acknowledged in the international guidance on CIA: "Several approaches/methods are available for assessing cumulative impacts; however, there is no one single method that should always be used; nor necessarily, one type of method for specific impacts or types of actions. The appropriate method is the one that best provides an assessment of the effects on the VECs being examined" (IFC 2013). This study applied a combination of tools and drew on inputs from subject matter specialists, government authorities (for example, Ministry of Energy and Mines and Ministry of Natural Resources and Environment), and stakeholders (local, national, and transboundary). Nonetheless, constraints were faced because of limited baseline data, uncertainty about proposed project developments, and absence of a strategic regional development plan.

The approach chosen for this study was to identify appropriate indicators of impact for each VEC (Table 4.2) and apply a score from 0 to 4 to indicate the size of the impacts:

0 = Negligible

1 = Slight

2 = Moderate

3 = Large

4 = Severe

Table 4.2: Summary of Valued Environmental Components, Indicators, and Primary Sources of Impact

VEC	Indicator	Primary sources of impact
Natural resource–dependent livelihoods		
Fisheries	Fish productivity (tons per year)	Hydropower development, inundation, flow regime change, and overfishing
Agriculture	Loss of agricultural land (hectares)	Hydropower development, inundation, flow regime change, sediment transport, mining, and plantations
Settlements (villages and towns)	Resettlement (people)	Hydropower development, inundation, flow regime change, wind and solar development, mining, and plantations
Non-timber forest products	Loss of forest (hectares)	Hydropower development and transmission lines, road development, forest and wetlands extraction, mining, and plantations
Terrestrial biodiversity and ecosystems		
Timber of commercial value	Loss of forest (hectares)	Hydropower development and transmission lines, road development, forest extraction, mining, and plantations
Protected and key biodiversity areas	Loss of protected habitats (hectares) and degree of fragmentation	Industrial and agricultural development, HPP and transmission line development, road development, and forest extraction
Changes in terrestrial fauna species	Level of habitat loss for indicator species (hectares)	HPP development and transmission lines, industrial and agricultural development, forest resource extraction, and road development
Community and culture		
Ethnic customs and values	Number of people from ethnic groups affected by resettlement	Industrial, agricultural, and HPP development
Gender roles	Numbers of women and men affected	Industrial, agricultural, and HPP development
Aquatic biodiversity and ecosystems		
Fish habitat fragmentation and connectivity	Degree of connectedness and fragmentation of aquatic habitats	HPP development and inundation
Changes in fish stocks	Effect of flow regime change on aquatic ecosystems and fish stocks	HPP development, inundation, overfishing, pollution, and water quality change

Note: HPP = hydropower plant.