Environmental Impact Statement/
Overseas Environmental Impact Statement
Hawaii-California Training and Testing

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3.3 Vegetation

VEGETATION SYNOPSIS

Stressors to vegetation that could result from the Proposed Action within the Study Area were considered, and the following conclusions have been reached for the Preferred Alternative (Alternative 1):

- Explosive: Explosives could affect vegetation by destroying individuals or damaging parts of individuals; however, there would be no persistent or large-scale effects on the growth, survival, distribution, or structure of vegetation, primarily due to the avoidance of sensitive habitats (e.g., hard bottom/seaweed habitat, seagrass beds) and recovery of relatively small areas of disturbed vegetation. As such, effects would be less than significant.
- Physical Disturbance and Strike: Physical disturbance and strike could affect vegetation by destroying individuals or damaging parts of individuals; however, there would be no persistent or large-scale effects on the growth, survival, distribution, or structure of vegetation. As such, effects would be less than significant.

3.3.1 Introduction

This section provides analysis of potential effects on vegetation found in the Study Area and an introduction to the species.

Vegetation includes diverse taxonomic/ecological groups of marine algae throughout the Study Area, as well as flowering plants in the coastal and inland waters. For this EIS/OEIS analysis, vegetation has been divided into eight groups that encompass taxonomic categories, distributions, and ecological relationships. These groups include blue-green algae (phylum Cyanobacteria), dinoflagellates (phylum Dinophyta), green algae (phylum Chlorophyta), coccolithophores (phylum Haptophyta), diatoms (phylum Ochrephyta), brown algae (phylum Phaeophyta), red algae (phylum Rhodophyta), and vascular plants (phyla Tracheophyta and Spermatophyte) (Table 3.3-1). Furthermore, the analysis considers the distribution of vegetation based on oceanic features and vertical distribution. Open-ocean oceanographic features of the Study Area include the North Pacific Subtropical Gyre and the North Pacific Transition Zone. Additionally, vertical distribution within the water column or the bottom substrate is considered. Informat

ion on the types of vegetation present in the Study Area are summarized below and detailed information provided in Appendix C.

3.3.2 Affected Environment

The affected environment provides the context for evaluating the effects of the proposed military readiness activities on marine vegetation.

3.3.2.1 General Background

The affected environment comprises two major ecosystem types, the open ocean and coastal waters; and two major habitat types, the water column and bottom (benthic) habitat. Vegetation typically grows only in the sunlit portions of the open ocean and coastal waters, referred to as the “photic” or "euphotic" zone, which generally extends to maximum depths of roughly 660 ft. (Lalli & Parsons, 1993). Because depth in most of the open ocean exceeds the euphotic zone, benthic habitat for vegetation is limited primarily to the coastal waters.

The euphotic zones of the water column in the Study Area are inhabited by phytoplankton, which are single-celled (sometimes filamentous or chain forming), free-floating algae primarily of four groups, including diatoms, blue-green algae, dinoflagellates, and coccolithophores; and non-free-floating algae, such as kelp and various species of benthic macroalgae. Microscopic algae can grow down to depths with only one percent of surface light penetration (Nybakken, 1993).

Vascular plants in the Study Area include seagrasses, cordgrasses, and mangroves, all of which have more limited distributions than algae (which are non-vascular), and typically occur in intertidal or shallow (< 40 ft.) subtidal waters (Green & Short, 2003). The relative distribution of seagrasses is influenced by the availability of suitable substrate occurring in low-wave energy areas at depths that allow sufficient light exposure for growth. Seagrasses as a rule require more light than algae, generally 15–25 percent of surface incident light (Fonseca et al., 1998; Green & Short, 2003). Seagrass species distribution is also influenced by water temperatures (Spalding et al., 2003).

Emergent wetland vegetation of the Study Area is typically dominated by cordgrasses (*Spartina foliosa*), which form dense colonies in salt marshes that develop in temperate areas in protected, low-energy environments on soft substrate, along the intertidal portions of coastal lagoons, tidal creeks or rivers, or estuaries, wherever the sediment is adequate to support plant root development (Mitsch et al., 2009).

In Hawaii, there are three species of seagrasses and at least 204 species of red algae, 59 species of brown algae, and 92 species of green algae. Seaweeds are important in native Hawaiian culture and are used in many foods (Preskitt, 2002, 2010). Red coralline algae and green calcareous (calcium-containing) algae (*Halimeda* species) secrete calcareous skeletons that bind loose sediments in coral reefs in Hawaii (Spalding et al., 2003). There are three kinds of seagrasses in the Hawaii Range Complex, Hawaiian seagrass (*Halophila hawaiiana*), which is only found in Hawaii; paddlegrass (*H. decipiens*), which is found in many parts of the world (National Marine Fisheries Service, 2023), and ditchgrass (*Ruppia maritima*) that is typically found in freshwater, but may be found in brackish water and the upper reaches of estuaries and lower portions of tidal creeks and rivers. While *H. hawaiiana* is found in relatively shallow waters between 0.5 and 4 m depth (NatureServe Explorer, 2023), *H. decipiens* is found subtidally at depth between approximately 6 and 30 m (Kenworthy, 2000). In the Northwestern Hawaiian Islands, beyond the coral reef habitat, algal meadows dominate the terraces and banks at depths of 98.4–131.2 ft. There are approximately 1,740.62 square miles of this type of substrate, an estimated 65 percent of which is covered by algal meadows (Parrish & Boland, 2004). Surveys from 2007 to 2016 generally showed a slightly higher percent cover of macroalgae compared to hard coral in the Northwestern Hawaiian Islands. However, higher percent cover of corals compared to macroalgae was observed along the main Hawaiian Islands (McCoy et al., 2016).

Abbott and Hollenberg (1976) reported 669 species of algae along the California coast, with one species of yellow-brown (Chrysophyta), 72 species of green (Chlorophyta), 137 species of brown (Phaeophyta), and 459 species of red algae (Rhodophyta). Marine vegetation along the California coast is currently represented by more than 700 species and varieties of seaweeds (such as corallines and other red algae, brown algae including kelp, and green algae), seagrasses (Leet et al., 2001; Wyllie-Echeverria & Ackerman, 2003), and canopy-forming kelp species (Wilson, 2002).

Detailed information on the major groups of vegetation in the Study Area is provided in Appendix C.

3.3.2.1.1 General Threats

Environmental stressors on marine vegetation are products of human activities (e.g., industrial, residential, and recreational activities) and natural occurrences (e.g., storms, surf, and tides). Species-specific information is discussed, where applicable, in Sections 3.3.3.2. The cumulative effect from these threats are analyzed in Chapter 4. General threats on marine vegetation include water quality, discharges from commercial industries, disease and parasites, invasive species, and marine debris. Detailed information on these threats is provided in Appendix C.

3.3.2.2 Endangered Species Act-Listed Species

No species of vegetation in the Study Area are listed as endangered, threatened, candidate, or proposed under the ESA.

3.3.2.3 Species Not Listed Under the Endangered Species Act

Thousands of vegetation species occur in the Study Area (Table 3.3-1).

Table 3.3-1: Major Groups of Vegetation in the Study Area

Marine Vegetation Groups		Vertical Distribution in the Study Area[2]		
Common Name[1] (Taxonomic Group)	Description	Open Ocean	Coastal Waters	Bays and Harbors
Blue-green algae (phylum Cyanobacteria)	Photosynthetic bacteria that are abundant constituents of phytoplankton and benthic algal communities, accounting for the largest fraction of carbon and nitrogen fixation by marine vegetation; existing as single cells or filaments, the latter forming mats or crusts on sediments and reefs.	Water column	Water column, bottom	Water column, bottom
Dinoflagellates (phylum Dinophyta [Pyrrophyta])	Most are single-celled, marine species of algae with two whip-like appendages (flagella). Some live inside other organisms, and some produce toxins that can result in red tide or ciguatera poisoning.	Water column	Water column	Water column
Coccolithophores (phylum Haptophyta [Chrysophyta, Prymnesiophyceae])	Single-celled marine phytoplankton that surround themselves with microscopic plates of calcite. They are abundant in the surface layer and are a major contributor to global carbon fixation.	Water column	Water column	Water column
Diatoms (phylum Ochrophyta [Heterokonta, Chrysophyta, Bacillariophyceae])	Single-celled algae with a cylindrical cell wall (frustule) composed of silica. Diatoms are a primary constituent of the phytoplankton and account for up to 20 percent of global carbon fixation.	Water column	Water column, bottom	Water column, bottom
Green algae (phylum Chlorophyta)	May occur as single-celled algae, filaments, and seaweeds.	Sea surface	Water column, bottom	Water column, bottom

Marine Vegetation Groups		**Vertical Distribution in the Study Area**[2]		
Common Name[1] **(Taxonomic Group)**	**Description**	**Open Ocean**	**Coastal Waters**	**Bays and Harbors**
Brown algae (phylum Phaeophyta [Ochrophyta])	Brown algae are large multi-celled seaweeds that form extensive canopies, providing habitat and food for many marine species.	Water column	Water column, bottom	Water column, bottom
Red algae (phylum Rhodophyta)	Single-celled algae and multi-celled large seaweeds; some form calcium deposits.	Water column	Water column, bottom	Water column, bottom
Vascular plants (phylum Tracheophyta, Spermatophyta)	Includes seagrasses, cordgrass, mangroves and other rooted aquatic and wetland plants in marine and estuarine environments, providing food and habitat for many species.	None	Bottom	Bottom

[1]Taxonomic groups are based on Roskov et al. (2015); Ruggiero and Gordon (2015); and the Integrated Taxonomic Information System. Alternative classifications are in brackets [ ]. Phylum and division may be used interchangeably.
[2]Vertical distribution in the Study Area is characterized by open-ocean oceanographic features (North Pacific Subtropical Gyre and North Pacific Transition Zone) or by coastal waters of two large marine ecosystems (California Current and Insular Pacific-Hawaiian).

3.3.3 Environmental Consequences

None of the proposed military readiness activities would be conducted under the No Action Alternative. Therefore, baseline conditions of the existing environment for vegetation would either remain unchanged or would improve slightly after cessation of ongoing military readiness activities. As a result, the No Action Alternative is not analyzed further within this section.

This section describes and evaluates how and to what degree the activities and stressors described in Chapter 2 and Section 3.0.3.3 potentially affect vegetation known to occur within the Study Area.

The stressors analyzed for vegetation are listed below:

- **explosives** (explosions in water)
- **physical disturbance and strikes** (vessels and in-water devices, MEM, seafloor devices, pile driving)

The environmental effects analysis considers standard operating procedures and mitigation measures that would be implemented under Alternative 1 and Alternative 2 of the Proposed Action.

As stated in Section 3.0.2, a significance determination is made only for activities that may have reasonably foreseeable adverse effects on the human environment based on the significance factors in Table 3.0-2. Both in-water explosives, and physical disturbance and strike, could have a reasonably foreseeable adverse effect; thus requiring a significance determination.

A stressor is considered to have a significant effect on the human environment based on an examination of the context of the action and the intensity of the effect. In the present instance, the effects of explosives or physical disturbance and strike would be considered significant if the effects have short-term or long-term changes well outside the limits of natural variability in terms of space; nutritional, physiological, or reproductive requirements within the Study Area. A significant effect finding would be appropriate if vegetation would be degraded over the long term or permanently such that its population in an area would no longer be sustainable.

3.3.3.1 Explosive Stressors

Table 3.3-2 contains a brief summary of background information that is relevant to the analyses of effects from explosive stressors. Detailed background information supporting the explosive stressor analysis is provided in Appendix F. Note that the use of explosives underwater has not been identified among the causes of decline in marine vegetation to date (Appendix C).

Table 3.3-2: Explosive Stressors Summary Information

Substressor	*Information Summary*
Explosions in the water	Explosions produce pressure waves with the potential to cause physical disturbance due to rapid changes in pressure and other physical effects. Charges detonated underwater could remove individuals or relatively small patches of vegetation. • The majority of underwater explosions occur on the surface and typically during the day at offshore locations greater than 3 NM from shore in water depths greater than 100 ft. (30 m), where only floating seaweed would be affected. • Explosions on or near the seafloor occur mostly in estuarine or shallow ocean waters, where much of the benthic vegetation (benthic macroalgae) grows on hard bottom areas and artificial structures. • If floating seaweed or benthic vegetation is in the immediate vicinity of an explosion, the taxa most likely affected are resilient to fragmentation and damage due to lack of vital organs, fast growth rate, and asexual reproduction.

Various types of explosives are used during military readiness activities. The type, number, and location of activities that use explosives are discussed in Chapter 3 and in Appendix A. While surface and near-surface explosives would be used throughout the Hawaii Study Area, underwater explosions would primarily occur in the vicinity of Pearl Harbor and Barbers Point that have been historically used for these activities, as well as at Pearl City Peninsula and Lima Landing in Pearl Harbor (Figure A-12). In the SOCAL Range Complex, underwater detonations would primarily occur in offshore areas, but could occur in San Diego Bay at the Echo location (Figure A-11) and in nearshore areas within the SSTC training lanes and training areas surrounding SCI over sandy bottom.

The potential for an explosion to injure or destroy vegetation would depend on the amount of vegetation present, the number of munitions used, and their net explosive weight. In areas where vegetation and locations for explosions overlap, vegetation on the surface of the water, in the water column, or rooted in the seafloor may be affected.

3.3.3.1.1 Effects from Explosives Under Alternative 1

Training and Testing. Effects on algae near the surface would be localized and temporary and are unlikely to affect the abundance, distribution, or productivity of vegetation. The depths, substrates, and relatively small areas of explosive footprints in comparison to vegetation distributions and total habitat areas in the Study Area indicate relatively little overlap between explosive footprints and the distribution of attached macroalgae and marine vascular plants. Furthermore, most underwater explosions associated with mine warfare take place in soft bottom habitats, and most bottom-placed explosions are detonated in established soft bottom locations. As a result, explosions would have very limited and localized (if any), temporary effects consisting of damage to or the removal of individuals and relatively small patches of vegetation. Vegetation, if present in soft bottom areas where bottom explosives are placed is expected to regrow or recolonize within a fairly short time (less than one year), resulting in no long-term effects on the productivity or distribution of macroalgae or marine vascular plants in those areas.

The effects from explosives during military readiness activities would be minimal disturbances of floating algal mats at the surface and negligible effects on macroalgae from bottom-placed explosives in soft bottom habitat. Areas with special status algal species such as eelgrass beds and kelp forests would be avoided to the greatest extent practicable. Refer to Section 3.5 for the effect of Proposed Action stressors on the abiotic habitat for vegetation.

Modernization and Sustainment of Ranges. Explosives would not be used during modernization and sustainment of ranges; therefore, there would be no explosives effects.

Conclusions. Activities that include the use of in-water explosives under Alternative 1 would result in less than significant effects since (1) the majority of underwater explosions occur on the surface and typically during the day at offshore locations greater than 3 NM from shore in water depths greater than 100 ft., where only floating seaweed would be affected; (2) explosions on or near the seafloor occur mostly in estuarine or shallow ocean waters, where vegetation (benthic macroalgae) is much less abundant compared to hard bottom areas and artificial structures; (3) if floating seaweed or benthic vegetation is in the immediate vicinity of an explosion, the taxa most likely affected are resilient to fragmentation and damage due to lack of vital organs, fast growth rate, and asexual reproduction; (4) most explosions would take place in soft-bottom habitats, and most bottom-placed explosions are detonated in the same established soft bottom locations where explosions would have very limited and localized (if any), temporary effects; and (5) areas with special status algal species such as eelgrass beds and kelp forests would be avoided to the greatest extent practicable. Refer to Section 3.5 for the effect of Proposed Action stressors on the abiotic habitat for vegetation.

3.3.3.1.2 Effects from Explosives Under Alternative 2

The only difference between Alternatives 1 and 2 in explosives use is that the number of explosives used would be greater under Alternative 2 (Table 3.0-10). Even though the number of explosives used in Alternative 2 would be greater than Alternative 1, potential effects on vegetation are not expected to be meaningfully different.

Therefore, the analysis conclusions for explosives used during military readiness activities under Alternative 2 would be the same as Alternative 1 and are consistent with a less than significant determination.

3.3.3.2 Physical Disturbance and Strike Stressors

This section analyzes the potential effects on vegetation of the various types of physical disturbance and strike stressors that may occur during military readiness activities within the Study Area. The evaluation of the effects from physical disturbance and strike stressors on vegetation focuses on proposed activities that may cause vegetation to be damaged by an object that is moving through the water (e.g., vessels and in-water devices), dropped into the water (e.g., MEM), or deployed on the seafloor (e.g., mine shapes, anchors, and fiber-optic cables). Specific locations of activities are given in Appendix A. Wherever appropriate, specific geographic areas of potential effect are identified.

Table 3.3-3 contains a brief summary of background information that is relevant to the analyses of effects from physical disturbance and strike stressors. Detailed information on physical disturbance and strike stressors in general, as well as effects specific to each substressor, is provided in Appendix F. Note that physical disturbance from human activities has been identified among the causes of decline in marine vegetation to date (refer to Appendix C).

Table 3.3-3: Physical Disturbance and Strike Stressors Summary Information

Substressor	*Information Summary*
Aircraft and aerial targets	Effects on vegetation from aircraft and aerial targets are not applicable and will not be analyzed further in this section.
Vessels and in-water devices	In general, there would be a higher likelihood of vessel and in-water device disturbance or strike in coastal areas than in the open ocean portions of the Study Area because of the concentration of activities and the comparatively higher abundances of vegetation in areas closer to shore (e.g., benthic macroalgae, floating seaweed). • In most cases, vessels and in-water devices would avoid contact with the bottom (and associated vegetation such as eelgrass) per standard operating procedures, unless the vessel/vehicle is designed to touch the bottom (e.g., amphibious vehicles). • Floating seaweed around a passing vessel would be mostly displaced, rather than struck, as water flows around the vessel or device due to its hydrodynamic shape. For the small amount of floating seaweed that is struck, the effect would be minimal; floating seaweed mats can remain floating and regrow despite fragmentation from strikes (Zaitsev, 1971). • In coastal ocean areas, neither vessels nor in-water devices would normally strike benthic macroalgae. The disturbance of seaweeds and other macroalgae by propeller wash would be temporary and negligible; benthic macroalgae in coastal areas is highly resilient to natural disturbances, such as storms and extreme wave action (Mach et al., 2007). In addition, major kelp forests would be avoided as much as practical by small boats. • The potential for vessels to affect vegetation on or near the bottom would occur mostly within nearshore locations. Vegetation in such areas could be affected by sediment disturbance or direct strike during vessel movement in shallow water (e.g., waterborne training, amphibious landings). • Although amphibious vehicles are designed to touch the bottom, they are generally used along ocean beaches and similar high-energy shorelines where the habitat is unsuitable for seagrass. Benthic microalgae that occur in soft bottom habitats associated with dynamic nearshore environments are also highly resilient to disturbance and recovers relatively quickly.
Military expended materials	Military expended material (MEM) deployed over water include a wide range of items that mostly pose a threat to vegetation located where the item settles or moves across the bottom. Before the item is buried or encrusted with marine growth, the effects on vegetation may include crushing directly under the material, abrasion from movement of the material, temporary increases in turbidity around the material, and coverage of the underlying substrate. • Most release of MEM occurs within the confines of established at-sea training and testing areas far from shore, although there is some release of expended materials within nearshore locations (e.g., San Clemente Island, off Oahu, and Pacific Missile Range Facility).

Table 3.3-3: Physical Disturbance and Strike Stressors Summary Information (continued)

Substressor	*Information Summary*
Military expended materials (cont.)	• The most heavily affected areas are offshore, where the potential for effects on benthic macroalgae are relatively low to negligible due to the depth limits of macroalgae growth in the Study Area as well as the dampening effect of water on sinking objects. • The dampening effect of water would reduce the effect of MEM on shallow seafloor habitats that are mostly soft or intermediate substrate vegetated primarily with benthic microalgae. Disturbance of benthic macroalgae on relatively rare hard substrate would be less likely, and the attached vegetation in coastal environments would be resilient to disturbance. • Decelerators/parachutes could cover vegetated habitats and prevent photosynthesis if they landed on the habitats in an open configuration. Prevailing currents and episodic storms would tend to dislodge the material until it is buried in soft substrate or snagged on hard substrate or artificial structures. The potential for expended decelerators/parachutes to drift into shallow, nearshore habitats from at-sea areas would be low. • Munitions and other MEM would be more likely to affect floating seaweed, although the algae are resilient to fragmentation from explosives, which is more damaging than the splash of expended materials. Strikes of floating seaweed would therefore have little effect and would not likely result in the mortality of individual plants.
Seafloor devices	Seafloor devices are either stationary (e.g., mine shapes, anchors, bottom-placed instruments, seafloor cables) or move very slowly along the bottom (e.g., bottom-crawling unmanned underwater vehicles) and mostly pose a threat to vegetation located where the device settles or moves across the bottom before being recovered. Effects may include crushing directly under the seafloor device and temporary increases in turbidity around the device. • Although placement of seafloor devices on bottom structure is avoided to ensure recovery, seafloor devices placed in depths less than about 95 meters may inadvertently affect macroalgae attached to hard substrate. A relatively high percentage of suitable hard substrate features macroalgae growth, although the percent coverage is variable in different regions and depths of the Study Area.
Pile driving	Pile driving and removal at Port Hueneme involves both impact and vibratory methods in soft substrate. Pile driving may have the potential to affect soft bottom habitats temporarily during pile driving, removal, and in the short term thereafter. There may also be some negligible loss of algae that colonizes the pilings when they are removed.

Single-celled algae may overlap with physical disturbance or strike stressors, but the effect would be minimal relative to their total population level and extremely high growth rates (Caceres et al., 2013); therefore, they will not be discussed further in this section. Marine vascular plants and macroalgae on the seafloor and on the sea surface are the only types of vegetation that occur in locations where physical disturbance or strike stressors may be encountered. Therefore, only marine vascular plants and macroalgae are analyzed further for potential effects from physical disturbance or strike stressors.

Supporting information on physical disturbance and strike stressors is provided in Appendix F, with the specific effect from each Alternative provided below.

3.3.3.2.1 Vessels and In-Water Devices

A variety of vessels and in-water devices would be used throughout the Study Area during military readiness activities, as described in Chapter 3. Most activities would involve one vessel or in-water device and may last from a few hours to two weeks, but activities may occasionally use two vessels or in-water devices. For this EIS/OEIS, more vessel traffic and in-water device use would occur in the California Study Area than the Hawaii Study Area (Table 3.0-17).

3.3.3.2.1.1 Effects from Vessel and In-Water Devices Under Alternative 1

Training and Testing. The effects from vessels during military readiness activities would be minimal disturbances of floating algal mats at the surface and macroalgae during amphibious landings, which will only occur at a few predetermined locations. Vessel movements may disperse or injure algae. However, floating algae would likely re-form shortly after the vessel is gone. Areas with special status algal species such as eelgrass beds and kelp forests would be avoided to the greatest extent practicable. As such, eelgrass bed damage is not likely but, if it occurs, the effects would be minor, such as damage from increased turbidity (Moore et al., 1996).

Modernization and Sustainment of Ranges. No vessels or in-water devices are involved in the proposed Special Use Airspace Modernization. Vessels and in-water devices associated with SOAR Modernization; SWTR Installation; Sustainment of Undersea Ranges; Hawaii and California undersea cable projects; and Installation and Maintenance of Underwater Platforms, Mine Warfare, and Other Training Areas would move very slowly during installation activities (0–3 knots) and would not pose a collision threat to vegetation. Since in-water devices would be placed primarily in soft bottom areas where most marine vegetation does not occur, effects on benthic vegetation would be less than significant.

Conclusion. Activities that include the use of vessels and in-water devices under Alternative 1 would not have a reasonably foreseeable adverse effect on the human environment since floating algae would reform after vessel passage; most vessels and in-water devices would avoid contact with the bottom and associated vegetation; and vessels that intentionally contact the bottom, such as amphibious vehicles, are used at ocean beaches and similar high-energy shorelines unsuitable for most marine vegetation.

3.3.3.2.1.2 Effects from Vessel and In-Water Devices Under Alternative 2

The only difference between Alternatives 1 and 2 in use of vessels and in-water devices is that the number of events using vessels or in-water devices would be greater under Alternative 2 (Table 3.0-17). Even though the number of events in Alternative 2 would be greater than Alternative 1, potential effects on vegetation are not expected to be meaningfully different.

Therefore, the use of vessels and in-water devices under Alternative 2 would be similar to Alternative 1 and would result in less than significant effects.

3.3.3.2.2 Military Expended Materials

This section analyzes the strike potential to vegetation of the following categories of MEM: (1) all sizes of non-explosive practice munitions; (2) fragments of high-explosive munitions; (3) expended targets; and (4) expended materials other than munitions, such as sonobuoys and miscellaneous accessories (e.g., canisters, endcaps, pistons). Refer to Appendix I for further details on the disturbance footprint for MEM on bottom habitat.

The potential for effects on marine vegetation from MEM would depend on the presence and amount of vegetation and quantity of MEM. Most deposition of MEM occurs within the confines of established activity areas. These areas are largely away from the coastline, and the potential for effects on vegetation is low.

Supporting information, including descriptions of the types of MEM that could affect marine vegetation, is presented in Appendix I.

3.3.3.2.2.1 Effects from Military Expended Materials Under Alternative 1

Training and Testing. Depending on the size and type or composition of the expended materials and where they happen to strike vegetation, individual plants could be killed, fragmented, covered, buried, sunk, or redistributed. This type of disturbance would not likely differ from conditions created by waves or rough weather. The likelihood is very low that any floating vegetated mat would accumulate enough material to cause sinking from military activities, as MEMs are dispersed widely through an activity area. Though remote, any potential strike would have little effect and would not likely result in the mortality of floating algal mats or other algae. Though MEM would be expected to settle onto sediments and could potentially settle onto vegetated marine benthic habitats, due to the broad dispersal of materials, MEM that settles to the seafloor would not be expected to occur at levels that would inhibit the persistence of marine vegetated habitats in the Study Area.

Modernization and Sustainment of Ranges. No MEM is expected during modernization and sustainment of ranges activities. However, some anchors may not be recovered and would become MEM. Those effects are covered below in the analysis of seafloor devices.

Conclusion. Activities that include the use of MEM under Alternative 1 would result in less than significant effects because (1) the affected area of MEM is very small relative to marine algae distribution, and (2) marine vascular plants overlap with areas where the stressor occurrence is very limited. Visual observation mitigation will be implemented prior to certain activities to observe floating vegetation. If floating vegetation is observed prior to the activity, that specific activity will either be relocated to an area where floating vegetation is not observed in concentrations, or the initial start of the activity will be ceased until the mitigation zone is clear of floating vegetation concentrations (Chapter 5). Based on these factors, potential effects on marine algae and marine vascular plants from MEM are not expected to result in detectable changes in the growth, survival, or propagation of individuals, and are not expected to result in population-level effect.

3.3.3.2.2.2 Effects from Military Expended Materials Under Alternative 2

The only difference between Alternatives 1 and 2 in use of MEM is that the overall quantity of MEM would be greater under Alternative 2 (Tables 3.0-16 through 3.0-19). Even though the quantity of MEM in Alternative 2 would be greater than Alternative 1, potential effects on vegetation are not expected to be meaningfully different.

Therefore, activities that include the use of MEM under Alternative 2 would be similar to Alternative 1 and would result in less than significant effects.

3.3.3.2.3 Seafloor Devices

Vegetation on the seafloor may be affected by stationary seafloor devices (e.g., mine shapes, anchors, bottom-placed instruments). In contrast, vegetation on the sea surface such as floating marine algal mats would not likely be affected by seafloor devices and therefore will not be discussed further in this section.

3.3.3.2.3.1 Effects from Seafloor Devices Under Alternative 1

Seafloor devices would be used throughout the Study Area during military readiness activities, as described in Chapter 2. Most seafloor device use would occur in the California Study Area. Seafloor devices use sandy substrates, devoid of marine vegetation, to the greatest extent practicable. Marine plant species found within the relatively shallow waters of the Study Area, including the Hawaii Range Complex and off SCI, are adapted to natural disturbance and recover quickly from storms, as well as from wave and surge action. Bayside marine plant species, such as eelgrass, are found in areas where wave action is minimal. Installation of seafloor devices may affect vegetation in benthic habitats, but the effects would be temporary and would be followed by rapid (i.e., within a few weeks) recovery, particularly in oceanside boat lanes in nearshore waters off San Diego and in designated training areas adjoining SCI. Eelgrass beds show signs of recovery after a cessation of physical disturbance; the rate of recovery is a function of the severity of the disturbance (Neckles et al., 2005). The main factors that contribute to eelgrass recovery include improving water quality and cessation of major disturbance activities (e.g., dredging) (Chavez, 2009). The Navy has used credits from the Navy Region Southwest San Diego Bay Eelgrass Mitigation Bank (Bank) to offset unavoidable eelgrass and other habitat effects from infrastructure projects and testing and training activities in San Diego Bay (U.S. Department of the Navy, 2023).

Training and Testing. Seafloor devices operation during military readiness activities could affect marine vascular plants by physically removing vegetation (e.g., uprooting); crushing vegetation; temporarily increasing the turbidity (sediment suspended in the water) of waters nearby; or shading, which may interfere with photosynthesis. If marine vascular plants are not able to photosynthesize, their ability to produce energy is compromised. Precision anchoring would not occur in mapped eelgrass or kelp locations, which would avoid vegetation that occurs there.

Seafloor device installation in shallow water habitats under Alternative 1 would pose a negligible risk to marine vegetation. Although some species would be expected to revegetate impacted areas within weeks to months, certain seagrass species could take years to recover. Although marine vegetation growth near seafloor devices installed during military readiness activities would be inhibited during recovery, population-level effects are unlikely because of the small, locally affected areas and the low frequency of military readiness activities in these localized areas.

Modernization and Sustainment of Ranges. New range modernization and sustainment activities include installation of undersea cables integrated with hydrophones and underwater telephones. Deployment of fiber optic cables along the seafloor would occur in three locations: south and west of SCI in the California Study Area, to the northeast of Oahu in the Hawaii Study Area, and to the west of Kauai in the Hawaii Study Area. In all locations the installations would occur completely within the water; no land interface would be involved. Cable-laying activities in the California Study Area could disturb marine vegetation when the cable crosses rocky substrate at depths between 65 and 196 ft. (20 and 60 m) for the SWTR Installation. However, it is anticipated that rocky substrate would be avoided to the greatest extent possible throughout the cable corridor to minimize these effects.

Installation and maintenance of underwater platforms, mine warfare training areas, and installation of other training areas involve seafloor disturbance where those activities would take place. Each installation would occur on soft, typically sandy bottom, avoiding rocky substrates.

Conclusion. Activities that include the use of seafloor devices under Alternative 1 would result in less than significant effects because (1) vegetation on the sea surface such as marine algal mats would not likely be affected by seafloor devices; (2) seafloor devices use sandy substrates, devoid of marine vegetation, to the greatest extent practicable; (3) marine plant species found within the relatively shallow waters of the Study Area are adapted to natural disturbance and recover quickly from storms as well as from wave and surge action; and (4) population-level effects are unlikely because of the small, locally affected areas and the low frequency of military readiness activities in these localized areas.

3.3.3.2.3.2 Effects from Seafloor Devices Under Alternative 2

The only difference between Alternatives 1 and 2 in use of seafloor devices is that the number of events using seafloor devices would be greater under Alternative 2 (Table 3.0-22). Even though the number of events in Alternative 2 would be greater than Alternative 1, potential effects on vegetation are not expected to be meaningfully different.

Therefore, activities that include the use of seafloor devices under Alternative 2 would be similar to Alternative 1 and would result in less than significant effects.

3.3.3.2.4 Pile Driving

Pile driving and removal would not affect vegetation on the sea surface, such as marine algal mats; therefore, floating vegetation will not be discussed further in this section. Pile driving for Port Damage Repair activities would occur in Port Hueneme harbor in the SOCAL Range Complex.

Pile driving and removal may, however, affect marine vascular plants and seafloor macroalgae at Port Hueneme by physically removing vegetation (e.g., uprooting); crushing vegetation; temporarily increasing the turbidity (sediment suspended in the water) of waters nearby; or shading, which may interfere with photosynthesis. If vegetation is not able to photosynthesize, its ability to produce energy is compromised. However, the intersection of marine macroalgae and marine vascular plants and pile driving is limited, and any suspended sediments would settle in a few days.

3.3.3.2.4.1 Effects from Pile Driving Under Alternative 1

Training and Testing. Pile driving and removal may affect vegetation in benthic habitats, but the effects would be temporary and would be followed by rapid (i.e., within a few weeks) recovery, particularly in areas with sandy bottoms with limited or no benthic vegetation. The effects of pile driving on vegetation would be temporary resuspension of sediment and the possible removal of relatively small amounts of vegetation during pile installation and removal. Pile driving for pier maintenance typically occurs in soft bottom habitats with unconsolidated sediments that would allow pile installation and removal at a fairly rapid pace. Most species would be expected to revegetate impacted areas within weeks to months.

Modernization and Sustainment of Ranges. Pile driving would not occur during modernization and sustainment of range activities.

Conclusion. Activities that include pile driving and removal associated with Port Damage Repair under Alternative 1 would result in less than significant effects because (1) vascular marine plant species found within Port Hueneme are adapted to normal changes in sedimentation; and (2) population-level effects are unlikely because of the small, locally affected areas and the low frequency of this activity in Port Hueneme.

3.3.3.2.4.2 Effects from Pile Driving Under Alternative 2

There is no difference between Alternatives 1 and 2 in pile driving. Therefore, activities that include pile driving under Alternative 2 would be the same as Alternative 1 and would result in less than significant effects.

3.3.3.3 Secondary Stressors

This section analyzes potential effects on marine vegetation indirectly exposed to stressors. Vegetation may be indirectly affected by suspended sediments and turbidity during military readiness activities.

Section 3.5 considers the effects on abiotic habitats, and Section 3.2 considers effects on sediments and water quality from explosives and explosion byproducts, metals, chemicals other than explosives, and other materials (e.g., marine markers, flares, chaff, targets, and miscellaneous components of other materials). An example from that analysis could be an increase in cyanobacteria associated with munitions deposits in marine sediments. Cyanobacteria may proliferate when iron is introduced to the marine environment. This proliferation can affect adjacent habitats by releasing toxins and can create hypoxic conditions. Introducing iron into the marine environment from munitions or infrastructure is not known to cause toxic red tide events; rather, these harmful events are more associated with natural causes (e.g., upwelling) and the effects of other human activities (e.g., agricultural runoff and other coastal pollution) (Hayes et al., 2007). High-order explosions consume most of the explosive material, leaving only small or residual amounts of explosives and combustion products. Many combustion products are common seawater constituents. Explosives byproducts from high-order detonations present no indirect stressors to marine vegetation through sediment or water.

The analysis included in Section 3.2 determined that neither state nor federal standards or guidelines for sediments or water quality would be violated by the No Action Alternative, Alternative 1, or Alternative 2. Because standards for sediment and water quality would not be violated, population-level effects on marine vegetation are not likely to be detectable and are therefore inconsequential. Because these standards and guidelines are structured to protect human health and the environment, and the proposed activities would not violate them, no indirect effects are anticipated on vegetation from the proposed military readiness activities under the No Action Alternative, Alternative 1, or Alternative 2.

Other materials that are re-mobilized after their initial contact with the seafloor (e.g., by waves or currents) may continue to strike or abrade marine vegetation. Secondary physical strike and disturbances are relatively unlikely because most expended materials are denser than the surrounding sediments (e.g., metal) and are likely to remain in place as the surrounding sediment moves. Potential secondary physical strike and disturbance effects may cease when (1) the MEM is too massive to be mobilized by typical oceanographic processes, (2) the MEM becomes encrusted by natural processes and incorporated into the seafloor, or (3) the MEM becomes permanently buried. Although individual organisms could be affected by secondary physical strikes, the viability of populations or species would not be affected.

3.3.4 Combined Stressors

3.3.4.1 Combined Effects of All Stressors

The analysis and conclusions for the potential effects from each of the individual stressors are discussed in the previous sections. Stressors associated with military readiness activities do not typically occur in isolation but rather occur in some combination. For example, mine neutralization activities include elements of several stressors that are all coincident in space and time, including acoustic, physical disturbance and strike, entanglement, ingestion, and secondary stressors. An analysis of the combined effects of all stressors considers the potential consequences of additive and synergistic stressors. This analysis assumes that most exposures to stressors are non-lethal, and instead focuses on consequences potentially affecting the organism’s fitness (e.g., physiology, behavior, reproductive potential).

Activities that have the potential to affect marine vegetation are widely dispersed, and not all stressors would occur simultaneously in a particular location. The stressors that may affect marine vegetation include explosives, physical disturbances or strikes (e.g., vessels and in-water devices, MEM, seafloor devices), and secondary stressors. The potential for exposure of marine vegetation to multiple stressors would be limited because activities are not concentrated in coastal distributions of these species. The combined effects of all stressors would not be expected to affect marine vegetation populations because (1) activities involving more than one stressor are generally short in duration, (2) such activities are dispersed throughout the Study Area, (3) activities are generally scheduled where previous activities have occurred, and (4) large resilient populations are present in the Study Area

Most of the activities proposed under both Alternative 1 and Alternative 2 generally involve the use of moving platforms (e.g., ships, torpedoes) that may produce one or more stressors. The minimal effects of far-reaching stressors (e.g., sound pressures, particle motion) may also trigger some animals to leave the area ahead of a more damaging effect (e.g., physical disturbance or strike). Individual stressors that would otherwise have minimal to no effect may combine to have a measurable effect. Due to the wide dispersion of stressor sources, speed of the platforms, and general dynamic movement of many military readiness activities, it is unlikely that highly mobile invertebrates would occur in the potential effects range of multiple sources or sequential exercises. Military readiness activities that produce MEM that fall to the bottom have the greatest potential to affect marine vegetation.

The combined effects under both Alternative 1 and Alternative 2 are not expected to lead to long-term consequences for marine vegetation. Based on the general description of effects, the amount of marine vegetation affected is expected to be small relative to overall densities and would not be expected to yield any lasting effects on the survival, growth, recruitment, or reproduction.

The combined effect of all stressors on marine vegetation is consistent with a less than significant determination.

3.3.5 Endangered Species Act Determinations

There are no marine vegetation species listed as endangered, threatened, candidate, or proposed under the ESA in the Study Area.

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