Eco Char	Vital Sign Category			Monitoring Objectives	VS Id#	Vital Sign	Monitoring Question(s)	Monitoring Method	Metrics	Vital Sign Rank (0-5)	COMMENTS / NOTES
Biotic Integrity	Terrestrial Ecosystems	Consumers	Community	Monitor community dynamics, structure, function, and composition	T19	Terrestrial Vertebrate (including off-shore islets refugia) Biodiversity	Are there long-term changes in selected native vertebrate communities?	Population surveys	Abundance and trends of selected vertebrate species or groups	3.3	
				Monitor effects of management on native communities	T21	Recovery/change of Native Wildlife and habitats (including wetlands) with restoration of native vegetation	What are trends in plant community composition and structure resulting from outplanting and seed-sowing activities? What is the response of native vertebrate and invertebrate populations to plant community restoration? What are priority plant species that should be restored?	Transects, plots (monitoring of areas where seeds have been broadcast and native species outplanted)	size classes, vigor, species composition, seedling recruitment, growth rates, Cover, animal reproductive success, animal popn size, animal popn growth rates, survivorship, density	3.2	
			Population	Monitor population size and distribution of native, endemic, or focal species, including response to restoration efforts. Where appropriate, measure demographics (size/age structure, reproduction, recruitment, etc.) of selected indicator species	T24	Herps (native)	Are distribution, abundance, other population characteristics, or habitat changing? Determine population levels over time.	Population surveys	Abundance / density, distribution	1.7	
				Monitor disease incidence and impacts, especially on native species	T30	Established Disease & Pathogens of Terrestrial Vertebrates	What is the incidence and level of disease in populations? Are diseases/pathogens affecting populations? What are trends in disease/pathogen?	Continue to monitor bird, bat, and herp populations (VCP, mist-netting)	incidence, Presence/ absence	2.5	
					T31	Alien Incipient Disease & Pathogens of Terrestrial Vertebrates	Where are disease locations outside parks? What species are they affecting? What are rates and directions of spread? Identify existing disease/pathogen incidence, impact, and trends	Surveys in high risk sites; passive surveillance,; education, outreach, public reporting, and follow-up	Presence/absence, rapid assessment of extent of infestations (distribution, identification and numbers of host and/or vector species involved)	2.5	
				Monitor extent and response to treatment of established invasive species	T32	Established Alien Species - Feral Ungulates	What are the relative abundance and population trends of feral ungulates? What are the impacts of feral ungulates? Is competition from invasive spp changing distribution, abundance, etc. of native spp.?	Animal activity transects	Index of ungulate damage (to both plants and animals as appropriate) index of erosion damage by ungulates, plant species recovery after removal of ungulates	2.4	
					T34	Established Alien Species - Predatory Terrestrial Vertebrates	Are native plant and animal species abundance or distribution changing in response to predators or predator control? What are trends in invasive species populations?	Treatment and control Transects/plots (for plants); other methods appropriate for native vertebrates of interest (VCP, transects, etc.); population surveys for predators	Plants: species composition, population and/or community structure. Animals: VCP, transects, other methods to monitor critical life stages identified as impacted by predators. Predator population indices, presence/ absence	3.4	
				Monitor occurrence of non-established (incipient) invasive species	T37	Alien Incipient Invasives - Predatory Terrestrial Vertebrate	Is species present, if so what is the nature and extent of infestation? What are the most effective strategies for detecting and preventing new invasives species? Where should efforts be focused? What are potential impacts?	Passive surveillance and follow-up on reports; education, outreach, and public reporting; surveys in high- risk sites	Predator population indices, presence/ absence, rapid assessment of extent of infestation	3.3	
					T40	Alien Incipient Invasives - Vertebrates	Is species present, if so what is the nature and extent of infestation? What are the most effective strategies for detecting and preventing new invasives species? Where should efforts be focused? What are potential impacts?	Passive surveillance and follow-up; surveys in high- risk sites	distribution, Presence/ absence, rapid assessment of extent of infestation	2.6	
	Marine Ecosystems	Water column (motile)	Population	Monitor disease incidence and impacts, especially on native species	M15	Established Marine Animal (other than turtles) Disease & Pathogens	What is the incidence and level of disease in populations? Are diseases/pathogens affecting populations? What are trends in disease/pathogen?	Incidence, telemetry	disease types, occurrence, tissue samples, vectors	1.9	
					M16	Established Turtle Disease & Pathogens	What is the incidence and level of disease in populations? Are diseases/pathogens affecting populations? What are trends in disease/pathogen?	incidence, telemetry (mark-recapture)	disease types, occurrence, vectors	2.9	

Intro, Monitoring goals & objectives, Conceptual Models, and Vital Signs

Also use main handout of review materials (http://www.nature.nps.gov/im/units/pacn/monitoring/plan/vs04/review_materials.htm)

Ecological Characteristic	Vital Sign Category			Monitoring Objectives
Human activities & cultural practices	Soundscapes			Monitor sound sources, frequencies, occurrence, and levels
	Viewscapes / Lightscapes			Monitor landscape / seascape appearance
				Monitor light levels and characteristics of light/dark cycles
	Land Use			Monitor points of entry for invasive species
				Monitor water use adjacent to or upstream from park boundaries
				Monitor land use adjacent to, or upstream of, park boundaries
	Park Use & Activities			Monitor debris-trash occurrence in coastal, riparian, wetland, and lacustrine habitats; in or near high use areas
				Monitor patterns of park visitation, use & damage (terrestrial & marine)
				Monitor incidence & occurrence of bioprospecting
				Monitor levels of take & harvest of harvested species (marine, freshwater, and terrestrial) or resources (coral, sand)
	Management Zones			Monitor patterns and effects of use and management
				Monitor effects of management practices on wilderness character
Physical / Chemical Environment	Climate & Air Quality			Monitor visibility
				Track rates of atmospheric deposition
				Track atmospheric concentrations of particulates and gases, levels of radiation--emphasizing those with known human health or environmental impacts
				Monitor core weather/climate conditions within each park (on each island)
				Monitor frequency and intensity (severity) of extreme events (hurricanes, waves, winds, rain, etc.)
				Identify and monitor spatial patterns of climate, such as trade-wind inversion elevation, lifting condensation level, lapse rates, etc.
	Soil, Water, & Nutrient Dynamics			Monitor physical ocean dynamics--ocean currents, sea level, tides/swell
				Monitor cycles of nutrients and elements within soils and water--including carbonate (oceanic), nitrogen, and phosphorous
				Monitor soil erosion
				Monitor soil quality trends (physical, toxics/contaminants, other biologic and nutrients)
				Monitor condition and extent of soil crusts
				Monitor trends in surface water flow regimes
				Monitor wetland (incl. anchialine ponds) water flow exchange dynamics, size, and distribution
				Monitor ground water flow rates and direction of movement (recharge)
	Water Quality			Monitor water quality core parameters
				Monitor supplemental water quality parameters
				Monitor microbiological water quality parameters
				Monitor toxic and contaminant levels in water
				Monitor biological invertebrate communities
	Geology	Hazards		Monitor surface volcanic activity (lava flows, eruption events & ground deformation)
				Monitor volcanic & non-volcanic seismicity
				Monitor extent, location, and causes of mass wasting events (e.g. landslides)
		Landforms		Monitor shoreline dynamics
				Track dune locations and topography
				Identify and monitor the extent of permafrost
				Monitor karst and non-karst cave and lava tube habitat characteristics, topography, and extent
Biotic Integrity	Terrestrial Ecosystems	Vegetation	Landscape	Monitor patterns of distribution & extent of community types
				Monitor fire regimes and effect on vegetation
				Track insect and disease presence during forest dieback
			Community	Monitor community dynamics, structure, function, and composition
				Monitor effects of management on native communities
			Population	Monitor effects of biocontrol on native and invasive species
				Monitor population size and distribution of native, endemic, or focal species, including response to restoration efforts. Where appropriate, measure demographics (size/age structure, reproduction, recruitment, etc.) of selected indicator species
				Monitor disease incidence and impacts, especially on native species
				Monitor extent and response to treatment of established invasive species
				Monitor occurrence of non-established (incipient) invasive species
		Consumers	Community	Monitor community dynamics, structure, function, and composition
				Monitor effects of management on native communities
			Population	Monitor effects of biocontrol on native and invasive species
				Monitor population size and distribution of native, endemic, or focal species, including response to restoration efforts. Where appropriate, measure demographics (size/age structure, reproduction, recruitment, etc.) of selected indicator species
				Monitor disease incidence and impacts, especially on native species
				Monitor extent and response to treatment of established invasive species
				Monitor occurrence of non-established (incipient) invasive species
		Cave Systems	Community	Monitor changes in cave communities
	Freshwater Ecosystems	Producers		Monitor community composition, structure, and productivity
		Consumers	Community	Monitor community dynamics, structure, function, and composition
			Population	Monitor disease incidence and impacts, especially on native species
				Monitor population size and distribution of native, endemic, or focal species, including response to restoration efforts. Where appropriate, measure demographics (size/age structure, reproduction, recruitment, etc.) of selected indicator species
				Monitor extent and response to treatment of established invasive species
				Monitor occurrence of non-established (incipient) invasive species
	Marine Ecosystems	Benthic	Landscape	Monitor patterns of distribution & extent of community types
			Community	Monitor community dynamics, structure, function, and composition
			Population	Track community and population trends in harvested fisheries / collected species
				Monitor population size and distribution of native, endemic, or focal species, including response to restoration efforts. Where appropriate, measure demographics (size/age structure, reproduction, recruitment, etc.) of selected indicator species
				Monitor disease incidence and impacts, especially on native species
				Monitor extent and response to treatment of established invasive species
				Monitor occurrence of non-established (incipient) invasive species
		Water column (motile)	Community	Monitor community dynamics, structure, function, and composition
			Population	Track community and population trends in harvested fisheries species
				Monitor disease incidence and impacts, especially on native species
				Monitor extent and response to treatment of established invasive species
				Monitor population size and distribution of native, endemic, or focal species, including response to restoration efforts. Where appropriate, measure demographics (size/age structure, reproduction, recruitment, etc.) of selected indicator species
				Monitor occurrence of non-established (incipient) invasive species
		Intertidal	Community	Monitor community dynamics, structure, function, and composition
			Population	Track community and population trends in harvested fisheries collected species
				Monitor population size and distribution of native, endemic, or focal species, including response to restoration efforts. Where appropriate, measure demographics (size/age structure, reproduction, recruitment, etc.) of selected indicator species
				Monitor extent and response to treatment of established invasive species
				Monitor occurrence of non-established (incipient) invasive species