CRITICAL HABITAT FOR FLORA AND FAUNA IN NEW JERSEY: REVISITING THE DEFINITION

EXECUTIVE SUMMARY

The Scientific Advisory Board, Ecological Processes Standing Committee (EPSC) was tasked with addressing issue: *Definition of Critical Wildlife Habitat*, as it is used to steward the conservation, protection and revitalization of New Jersey's natural resources. It is important to note at the outset that the EPSC's attempts are based solely on a *scientific* review of the topic(s). No attempt is made to formulate new or revised policy, but simply to use the best available science to inform policy and assist decision makers in managing the State's valuable natural capital. The EPSC approached the challenge by adopting an Ecosystem-Based Management (EBM) framework, one that considers multiple activities within specific areas defined by *ecosystem* rather than *political* boundaries. It also places humans in the landscape, within the broader context of the biological and physical environment, and ultimately combines ecology and human dimensions into "society-integrated" management guidelines. This is the essence of sustainable development that recognizes the importance of the life support systems around us, systems that we are an integral part of. We go beyond simple consideration of threatened and endangered species to consider aspects of ecosystem integrity, functions and processes, and community/population biology that allows ecosystems to persist in a 'healthy' state, one that not only improves habitats for species in jeopardy, but prevents other species from achieving this dubious distinction.

We are, however, equally sensitive to sustaining a 'balance' between ecology and economy because the quality of life for all New Jersey's citizens also depends on a healthy economy. The state is not only rich in productive human enterprises, but is also rich in resources that provide the natural capital (goods and services) needed for human well-being: clean water, clean air, fertile soils, abundant wildlife, and ample recreational opportunities for families to enjoy nature. Meeting human needs in our rapidly growing state, however, has placed increasing pressures on the natural world and its ability to contribute to our well-being, and has resulted in ecosystem degradation, with concomitant loss of ecosystem goods and services throughout the region. We cannot sustain a healthy economy without stewardship of the life support systems around us.

Early in EPSC's deliberations, it became clear that the term 'critical wildlife habitat, as presently used, fell short of its ultimate ecological context; e.g., how to include flora [1] and other components in the definition that are critical to ecosystem health, processes and functions. The EPSC therefore suggests that New Jersey resource agencies, managers and decision makers adopt the broader term *Critical Habitat* as the best descriptor for natural resource management in the New Jersey. The basis for this statement is laid out in the body of the report, an approach that largely adopts ecosystem-based management for protecting, conserving and managing New Jersey's natural capital.

It should also be noted that any discussion of "critical habitat" must include at least two key elements. The first addresses scale (in part) and the traits of ecosystems that make them resilient. On the one hand, the definition must include structural, process and functional ecosystem attributes such as diversity, complexity, trophodynamics (food web complexity), primary and secondary production, and other characteristics that reduce the risk of ecosystems transforming to some new, less desirable, stable state. Thus the definition should include traits at the "community level". Secondly, whether already designated threatened and/or endangered, or species of concern or likely to become so in the future, the second element of the definition should address "population" characteristics, and the ability of species to sustain their populations relative to critical patch size (breeding, feeding and resting areas), edge (transition zones among habitats), presence of contaminants, and a plethora of other factors that affect population

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[1] Flora are not usually included in the term "wildlife".

dynamics. This approach is but one way to include the definition of critical habitat for threatened species (at the population level) within the overall ecosystem health of those critical life support systems that also includes humans at the community level.

Biogeography should be considered when identifying the areas that need to be protected and managed as *Critical Habitat*. Biogeographic provinces have been well established and defined in New Jersey by the Division of Fish and Wildlife and serve to organize the state's efforts to implement the New Jersey Wildlife Action Plan. Preserving the flora and fauna that characterizes these biogeographical zones protects the natural heritage of New Jersey and ecological processes unique to the state. It also promotes biodiversity which makes wildlife more resilient to threats such as disease, habitat fragmentation, pollution and invasive species. Unfortunately, landscape transformation that supports the expansion of human enterprises is believed to be the driving force in the loss of biodiversity worldwide and because humans are so dominant in the Earth's ecosystems it is urgent that we take more responsibility for better managing the natural world. More specifically, the earth's ecosystems have been doing relatively well for 2.5 billion years, and are quite capable of managing themselves, the issue for the future is that we humans need to do a better job of managing ourselves!

The land use requirements of New Jersey's large and growing human population (as noted earlier, New Jersey is the most densely populated state in the nation) have led to extensive conversion of natural habitat. In large parts of the United States, including New Jersey, more than half of the original vegetation types have been destroyed, converted to agriculture, housing, industrial use, and plantation forestry. Losses of wetlands are equally dramatic; it is believed that half of all wetlands in the continental US and New Jersey have been lost in the past century. It is a fundamental ecological principle that a given species can tolerate only a limited range of habitat variability, so the documented degree of habitat destruction and alteration in the US has led to an enormous toll of extinction and endangerment. Many species are specialized to use only a narrow range of habitats, and such habitat specialists have been particularly affected by habitat alteration and destruction.

One of the important consequences of historical land use patterns in the state, including accelerated urbanization, is that greater fragmentation of remaining habitats leads to smaller and more isolated species populations and increasing potential for extinction. This is precisely why New Jersey decision makers are trying to address the issues of threatened and endangered species and the need to catalogue the State's *Critical Habitats* to protect currently endangered taxa and prevent others from being added to the list.

Similarly, the EPSC addressed potential impacts on *Critical Habitat* and its functions associated with invasive species, climate change and eutrophication:

Invasive Species - Biological invasions can have substantial, multifaceted effects on biodiversity and ecosystem functions. Some invasive plants transform entire landscapes, and may completely eliminate species locally. The invasive variety of *Phragmites australis*, for example, forms dense monocultures in brackish wetland regions of New Jersey, and severely alters habitat complexity, diversity and numerous functions and processes in these wetlands. *P. australis* covers more than 16,000 hectares (40,000 acres) in the upper Delaware estuary alone, and forms similarly extensive stands in other areas such as the Hackensack Meadowlands. Introduced species can have many other impacts, some of them quite subtle

(e.g., changed nutrient cycles, and its influence on biomass production) that can affect entire ecosystems to the great detriment of many of the native animals and plants.

Climate Change - Climate change due to human activities is modifying the distribution, abundance, and behavior of aquatic and terrestrial organisms, and is therefore, likely to significantly alter fundamental ecological responses within diverse ecosystems. Among all the predicted effects of climate change, sea level rise may be one of the most significant and growing threats to New Jersey coastal areas. Sea level rise is a well-documented physical reality that is impacting coastline in New Jersey and throughout the world. Effects of sea level rise could include coastal inundation, coastal flooding, coastal beach erosion, and salt water intrusion. Worldwide, natural coastal systems are highly susceptible to the effects of sea level rise, and the loss of coastal wetlands and beaches will likely produce significant ecological impacts and result in a loss of ecological services (e.g., coastal recreation). The mid-Atlantic coast contains some of the most valuable estuarine and wetland ecosystems in the U.S. and is also among the most threatened due to sea level rise. Recent projections indicate that sea-level in the mid-Atlantic region may rise from 46 to as much as 190 cm (18-75 inches). It is estimated that 1 to 3% of the land area in New Jersey will be affected by inundation and 6.5% to over 9% by episodic coastal flooding over the next century.

Eutrophication – Defined as an excess of nutrients in the water column, eutrophication is arguably the most serious threat to aquatic ecosystems. Due to combined point and non-point source inputs, nutrient enrichment is prevalent throughout New Jersey and the region. Combined with atmospheric depositions, anthropogenic inputs of nitrogen and phosphorus, from urban and municipal sources in northern New Jersey and agricultural runoff in southern New Jersey, affect watersheds statewide. *Critical Habitat* is especially vulnerable to eutrophication that affects ecosystem structure and function, and influences oxygen concentrations in poorly flushed aquatic systems, e.g. Lake Hopatcong, Barnegat Bay, and coastal waters of New Jersey. As a consequence, entire aquatic ecosystems and their critical habitats may be altered and/or degraded.

A key task for the committee was to discuss how we might measure *Critical Habitat* and the limitations of the science. Elements of that discussion included: (1) transferring knowledge into concrete actions; (2) reconciling conservation objectives with the aims of economic development by sustaining essential ecological processes and life support systems; (3) ensuring that the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony; (4) defining sustainable development in terms of integrated ecological, socio-economic and cultural factors; (5) understanding that once satisfactory definitions have been developed, indicators (ecological, socio-economic and cultural) for measuring progress towards a sustainable New Jersey should also be formulated; and (6) understanding that in the future, ecological constraints be recognized in determining the limits of economic activities and social development. Although the NJDEP has been in the national forefront in stewardship of its natural capital and conserving its ecosystems, The EPSC believes that much more can be done to balance ecology and economy, but necessarily in that order!

Clearly, there are limitations of the present state of the science, but that should not stop scientists with engaging the community of stakeholders, decision makers and managers to more effectively steward New Jersey's priceless natural resources. Current evidence demonstrates that the resistance of ecosystem functioning to disturbance is strongly dependent on ecosystem diversity, a finding consistent with the observation that more diverse (species rich) ecosystems are more stable. However, it is less clear from recent work if ecosystem resilience similarly rests in

biodiversity. Although there appears to be an upper limit between primary productivity (i.e., foodstuff produced by green plants) and biodiversity in both natural and agricultural ecosystems, it is also clear that management practices that maintain diverse forests, grasslands and aquatic systems will help ensure the sustained production of the ecological goods and services we all depend on.

Despite scientific advances, we still have only rudimentary knowledge of many ecosystem processes, in part, because there have been few long-term experiments and many functional processes and ecosystems themselves have never been explored. We need far better knowledge of the number of species required to assure the sustainability of various ecosystem functions and how they depend on spatial patterning, spatial scale and time. Addressing these shortcomings will be of great importance for sustainably managing ecosystems to provide sustainable flows of services essential for human well-being.

Finally, the EPSC considered the current regulatory purview for protecting rare species and their habitats. Although much desirable content appears therein, the standing committee recommends that New Jersey's regulations for protecting rare species and their habitats be integrated into a single set of rules, and streamlined for consistency and inclusion of the tenets presented herein.