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THE HYDROLOGICAL IMPACT OF THERMOELECTRIC ENERGY PRODUCTION IN MASSACHUSETTS

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Global water and energy demands are only increasing, and the inextricable link between water and energy production has been understudied. The following paper is an analysis of water use rates for thermoelectric power generation in the Commonwealth of Massachusetts, and it considers the geospatial relationship between power producing facilities and their natural environment for the years 2001-2006. The state's energy industry falls within the larger context of the thermoelectric power industry in the United States, which here serves as a baseline for comparison. All of Masachusetts'126 large-scale power facilities are considered, in order to identify the counties that produce the most electricity. Special attention is given to the 24 largest power producers in Massachusetts (i.e. those with a nameplate production capacity of greater than 100 megawatts). They are mapped in great detail (i.e., to the street level). We use water withdrawal and consumption information for these 24 power plants to identify the most water-efficient plants and areas of Massachusetts for the years 2001-2005. Water withdrawal and consumption rates depend primarily upon cooling type, although plant fuel type and plant age are also considered. States in the eastern U.S. typically use open loop cooling systems, and Massachusetts is no exception. Open loop cooling systems withdraw roughly two orders of magnitude more water than closed loop systems, while consuming roughly the same amount.

Areas of Critical Environmental Concern (ACEC), as identified by the Massachusetts Department of Conservation and Recreation (MDER) are also identified and mapped, in addition to bodies of water (e.g., rivers, lakes), watersheds, and land cover. The intent of this paper is two-fold: to identify power plants in Massachusetts that may be negatively affected by severe and prolonged drought or by sea level rise, and to identify areas in Massachusetts that are particularly susceptible to a reduction in water resources as a consequence of their proximity to power plants that have a high withdrawal rate. Facilities having the highest withdrawal rates are the most susceptible to prolonged and severe drought, while coastal facilities are the most susceptible to sea-level rise. The analysis has the added benefit of being able to identify individual plants for targeted improvement of water use efficiencies in order to contribute to watershed conservation. Furthermore, this paper may serve as a template for other states for the future identification of at-risk thermoelectric plants and at-risk watersheds and coastal ecosystems.

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