Efficiency in spectrum utility has been a concern in wireless communications for a long time. Cognitive radios have been seen as a solution to occupy the gaps in the licensed spectrum through opportunistic spectrum access and simultaneous spectrum sharing techniques. For this purpose, spectrum sensing has been vital in providing accurate statistical information regarding licensed or primary user (PU) activity on its spectrum. In this paper, we design new sensing thresholds that take into account the outage caused to the PU as a consequence of cognitive or secondary users (SUs) accessing or sharing the said spectrum. With these new thresholds, we can see more protection to the PU from SU spectrum access transmissions based on missed detections, and eliminate most common assumptions made with spectrum sharing systems. Our thresholds also work with a dynamic decision-making algorithm that allows the SUs to use only the statistical sensing information to understand the network dynamics, and determine its transmission opportunities and corresponding power consumption, in a decentralized and uncooperative cross-layer network.