We demonstrate wavelength-division-multiplexed (WDM) and space-division-multiplexed (SDM) transmission of probabilistically shaped polarization-division-multiplexed (PDM) 1024-state quadrature amplitude modulation (QAM) channels over a 9.7-km single-mode 30-core fiber, achieving aggregated spectral efficiency of 297.82 bit/s/Hz on a 12.5-GHz grid and 7.01-Tbit/s spatial-super-channel on a 25-GHz grid without multiple-input multiple-output (MIMO) processing. Actual soft-decision forward error correction (SD-FEC) decoding was employed to obtain error-free performance, and adaptive rates and spectral efficiencies for individual WDM/SDM channels have been applied according to their channel conditions, by adjusting the SD-FEC overhead without changing the modulation format. Probabilistically shaped PDM-1024-QAM has been used to further increase the aggregated achievable rate due to the added performance improvement through shaping gain.