Model Equations:

$$
\begin{aligned}
\frac{dV_S}{dt} &= B_V V - (a + \sigma_V + \mu_V)V_S,\\
\frac{dV_E}{dt} &= a\lambda_{VH}V_S - (\tau_V + \mu_V)V_E,\\
\frac{dV_I}{dt} &= \tau_V V_E - \mu_V V_I,\\
\frac{dV_R}{dt} &= [a(1-\lambda_{VH}) + \sigma_V]V_S - \mu_V V_R,\\
\frac{dH_S}{dt} &= B_H + \delta_H H_R - a\beta_H V_I \frac{H_S}{H} - \mu_H H_S,\\
\frac{dH_E}{dt} &= a\beta_H V_I \frac{H_S}{H} - (\tau_H + \mu_H)H_E,\\
\frac{dH_{I_1}}{dt} &= \nu_H \tau_H H_E - (\gamma_{H_1} + \mu_H)H_{I_1},\\
\frac{dH_A}{dt} &= (1-\nu_H)\tau_H H_E - \frac{\gamma_{H_1}\gamma_{H_2}}{\gamma_{H_1}+\gamma_{H_2}} H_A - \mu_H H_A,\\
\frac{dH_{I_2}}{dt} &= \gamma_{H_1} H_{I_1} - [\rho\epsilon_2\zeta + (1-\rho)\gamma_{H_2} + \rho(1-\epsilon_2)p\zeta + \mu_H]H_{I_2},\\
\frac{dH_R}{dt} &= \rho\epsilon\zeta H_{I_2} - (\delta_H + \mu_H)H_R
\end{aligned}
$$

where human birth rate $B_H = \mu_H H + [(1-\rho)\gamma_{H_2} + \rho(1-\epsilon_2)p\zeta]H_{I_2}$, the tsetse density-dependent mortality rate $\mu_V = \mu_{V_0}(1 + \mu_{V_1} V)$ and the force of infections

$$
\lambda_{VH} = \beta_{VH}\frac{H_{I_1} + kH_A}{H},
$$