Table 1. The equations for models discussed in the main text.

Model	Equations	Notes
1	Predator-prey model $dN/dt=r(1-N/K)N - c_1NP$ $dP/dt=cNP - mP$ $(r,b,K,\theta,m,c_1)_{ave}=(1.75,1.75,2.0,0.5,0.5,expt)$ $(r,b,K,\theta,m,c_1)_{ave}=(0.25,1.5,0.29,0.5,0.5,expt)$	N prey, P predator populations a,b prey intrinsic birth, death rates r =a-b prey intrinsic growth rate m predator intrinsic death rate K carrying capacity; c predation parameter $\theta=c/c_1$ energy conversion efficiency factor
2	SIRS model $dS/dt=aH(1-(r/a)(H/K))-\beta IS+\sigma R-(b+v(t))S$ $dI/dt=\beta IS-(b+\gamma+\alpha)I$ $dR/dt=\gamma I-(b+\sigma)R+v(t)S$ $v(t)=C\exp(\delta_2\cos(2\pi t/(mp))$ with vaccination; $v(t) = 0$ otherwise. $(a,b,K,\alpha,\gamma,\sigma,\beta,\delta_2)_{ave}=(0.9,0.5,1.0,0.2,0.55,0.1,expt,10.0)$	S=susceptible;I = infectious; R=recovered H= S + I + R; d = $(b+\gamma+\alpha)$ a; b; r: intrinsic birth; death; growth rates. β disease transmission rate γ, σ transition rates between stages α infection induced mortality K carrying capacity
3	SEIRS model $dS/dt=aH(1-(r/a)(H/K))-\beta IS+\sigma R-(b+v(t))S$ $dE/dt=\beta IS-(b+\gamma)E$ $dI/dt=\gamma E-(b+\mu+\alpha)I$ $dR/dt=\mu I-(b+\sigma)R+v(t)S$ $(a,b,K,\alpha,\gamma,\sigma,\mu,\beta)_{ave}=$ $(0.9,0.5,1.0,0.2,0.3,0.1,0.25,expt)$	E = exposed; H= S + E + I + R; a; b; r; H; K; v(t), d as in Model 2. γ,μ,σ transition rates between stages
4	(SIS)Host-host-pathogen model $dS_1/dt =a_1H_1(1-(r_1/a_1)(H_1/K_1))-(\beta_{11}I_1+\beta_{12}I_2)S_1 -b_1S_1+\gamma_1I_1$ $dI_1/dt=(\beta_{11}I_1+\beta_{12}I_2)S_1-(b_1+\gamma_1+\alpha_1)I_1$ host 2 equations as for host 1 with 1<->2. $(a_1,a_2,b_1,b_2,K_1,K_2,\alpha_1,\alpha_2,\gamma_1,\gamma_2,\beta_{11},\beta_{22},\beta_{12},\beta_{21})_{ave}=$ $(1.0,0.5,0.5,0.25,1.0,2.0,0.75,0.3,0.25,0.31,1.0,0.25,0.063,expt)$	Parameters and variables as in Model 3 β_{ij} are the intra- and inter-transmission rates. $d_i=(b_i+\gamma_i+\alpha_i)$
5	Predator-prey-prey model $dN_1/dt=r_1(1-N_1/K_1)N_1 - c_1N_1P$ $dN_2/dt=r_2(1-N_2/K_2)N_2 - c_2N_2P$ $dP/dt=c_1N_1P + c_2N_2P - mP$ $(r_1,r_2,K_1,K_2,m,c_1,c_2)_{ave}=$ $(1.0,0.75,2.0,3.0,0.25,expt,1.1)$	N_1,N_2 prey; P predator r_1,r_2 intrinsic growth rates m predator intrinsic death rate K_1, K_2 carrying capacities c_1, c_2 predation parameters

Table 2: Threshold values of predation parameter "c_1" for predator-prey Model 1.

p	A	B	C	D	E	F
1	0.485	0.518	1.437	1.494	3.43	4.45
5	0.392	0.690	0.543	1.032	2.84	10.03
10	0.362	0.800	0.384	0.981	2.55	13.81
20	0.350	0.864	0.352	0.937	2.46	16.21
unforced	0.5	0.5	0.5	0.5	3.5	3.5
threshold	lowered	raised	raised/ lowered	raised	lowered	raised
forced	r,K,c	r,K,c	K,c	K,c	b,K,c	b,K,c
fixed	r/K	r/K	r	r	a, r/K	a, r/K
phase	in phase	out of phase	in phase	out of phase	in phase	quarter cycle lag
white noise	0.43	0.59	0.52	0.75		

Table 3: Infection threshold values of transmission rate β for SIRS Model 2.

p	A	B	C	D	E	F
1	1.25	1.26	3.95	1.39	3.70	2.25
5	1.14	1.37	3.65	1.52	1.77	1.39
15	0.92	1.95	2.75	2.21	1.42	1.35
30	0.81	2.66	2.55	3.05	1.33	1.33
unforced	1.25	1.25	1.25	1.25	1.25	1.25
threshold	lowered	raised	raised	raised	raised	raised
forced	a, K, β	a, K, β	K, β	a, K, β	vacc, β	vacc, β
fixed	r/K, b no vacc	r/K, b no vacc	a, b no vacc	r/K, b no vacc	a, b, K	a, b, K
phase	in phase	out of phase	out of phase	out of phase	quarter cycle	in phase
					m = 1	m = 2

Table 4: Infection threshold for multi-host Model 4.

p	A	B	C	D	E
1	1.44	1.42	1.43	1.44	10.77
5	1.33	1.03	1.11	1.51	8.42
15	1.12	0.37	0.15	2.39	5.52
unforced	1.44	1.44	1.44	1.44	1.44
threshold	lowered	lowered	lowered	raised	raised
forced	β only	β only	r_1,K_1,β	r_1,K_1,β	K_1,β
fixed			$r_1/K_1,r_2,K_2$	$r_1/K_1,r_2,K_2$	r_1,r_2,K_2
phase	$\phi_2 = 0$	$\phi_2 = \pi$	$\phi_2 =0,\phi_3=0$	$\phi_2=0,\phi_3=\pi$	$\phi_2=0,\phi_3=\pi$

Table 5: Invasion and Resonance in predator-prey-prey Model 5.

p	A; c_1	B:N_{1max}	p	C; c_1	D:N_{1max}
1	1.33	0.21	1	1.33	0.24
5	1.33	0.35	5	1.33	0.52
10	1.23	1.38	9	1.17	1.75
13	1.28	0.90	12	1.14	1.9
24	1.17	1.60	14	1.25	1.4
28	1.26	1.35	18	1.03	1.77
			23	0.82	1.99
			28	0.90	1.76
unforced	1.33			1.33	
threshold	lowered			lowered	
forced	r_1, r_2			r_1, r_2 c_1, c_2	
fixed	K_1, K_2 c_1, c_2			K_1, K_2	
phase	in phase			quarter cycle	