Table 1. Complete component list for World4 model in four parts. (a) Variables. (b) Flows. (c) Stocks. (d) Equations. Variables in bold italics were fit to data. Best value is one solution of many. Range shows values that can be fit to data with less than a specific residual depending on range of years fit. Fit years is the range used for fitting in *hyperfit*.

(a)

Var.	Best value	Range	Fit years	Physical meaning
a	0.426	0.35 to 0.48	1970-2010	Ecosystem fragility. Relates cc_E vs *ecosphere*. A higher/lower ***a*** means that ecosystem services are fragile/robust with respect to *ecosphere*, respectively
b	1.0 people/gha	0.7 to 1.7	1000-1970	Base level carrying capacity for *ecosphere*.
c	5.5 people/gha	4.5 to 7.0	1000-1970	Base level carrying capacity for *humansphere*.
d	-110	-150 to -90	n/a	Rule of diminishing returns. Relates *knowledge* to *CC*. A more negative value for ***d*** means *knowledge* raises *CC* more.
E_0	7.05E+09 gha	4.3e9 to 8.1e9	1970-2010	Initial biocapacity of the *ecosphere*.
H_0	1.5e8 gha	1.2e8 to 1.6e8	1-1970	Domesticated land in 0CE. Initial value of *humansphere*.
I_0	0.05 y^{-1}	0.05 to 0.25	n/a	Base mortality. Multiplied by *humansphere* to get *rewilding*. Must be higher than maximum value of *knowledge*. Past population is insensitive to this variable but it affects future population.
K_0	7.25e-11 y^{-1}	2.0e-11 to 2.0e-9	1000-1970	Technology in Year 0. Initial value of *knowledge* in 0CE.
p	n/a	0 to 1.0	n/a	Enforcement level of conservation policy. Higher ***p*** means stronger enforcement of policy.
py	n/a	0 to inf.	n/a	Policy phase-in time of conservation policy. Linear phase-in for enforcement of conservation policy *w*.
sy	n/a	1960 to inf.	n/a	Starting date of phase-in of conservation policy. When $p_E < w$, *domestication* is multiplied by $g = g(((y\text{-}sy)/py)p+(1-(y\text{-}\mathbf{sy})/py)(1-\exp(-10(w-p_E))) + \exp(-10(w-p_E))$, where y is the current year. Used only in the phase-in period *sy* through ***sy+py***.
u	-8.6	-inf. to -6.5	1970-2010	Aggressiveness of growth.
v	-11.46	-inf. to -9.0	1970-2010	Aggressiveness of technological development.
w	n/a	0 to 0.5	n/a	Fraction of *ecosphere* to save using conservation policy. When $p_E < w$, *domestication* is multiplied by $p\ (1-\exp(-10(w-p_E))) + \exp(-10(w-p_E))$
$\varkappa$	9.6E-03 y^{-1}	6.5e-3 to 1.0e-2	1000-1970	Learning rate. Rate of the intrinsic growth of *knowledge*.
τ	852 y	700 to 1525	1-1970	Doubling time of *humansphere* in Year 0.

(b)

Flow	Source	Sink	Formula	Physical meaning
rewilding	*humansphere*	*ecosphere*	*ignorance* • *humansphere*	Deaths expressed as change in ecological footprint.
domestication	*ecosphere*	*humansphere*	*g* • *humansphere*	Births expressed as change in ecological footprint.
learning	*ignorance*	*knowledge*	$\varkappa$ • *knowledge*	Intrinsic technology growth.
obsolescence	*knowledge*	*ignorance*	*r* • *knowledge*	Loss of technology.

(c)

Stock	Initial value	Physical meaning
humansphere	H_0	Amount of total biocapacity appropriated for human use in Year 0, in gha.
ecosphere	E_0	Amount of total biocapacity not appropriated for human use in Year 0, in gha.
knowledge	K_0	Mortality eradicated by technology, in per year rate units y^{-1}.
ignorance	I_0	Base mortality rate. Eradicated by technology. In per year rate units, y^{-1}.

(d)

Equation	Formula	Physical meaning
cc_E	$\mathbf{b}\ p_E^{(\mathbf{0.5}/(1+\mathbf{pE}\text{-}\mathbf{2a}))}$	Carrying capacity contributed by the ecosphere.
cc_H	$\mathbf{c}\ (1 - exp(\mathbf{d} \bullet knowledge))\ \mathbf{cc}_E$	Carrying capacity contributed by the humansphere .
p_E	$ecosphere/\mathbf{E_0}$	The wild fraction of the environment.
g	$(\mathbf{I_0} + ln(2)/\boldsymbol{\tau})(1-exp(\mathbf{u}\ p_E))$	ecosphere-dependent net intrinsic growth rate of humansphere
r	$exp(\mathbf{v}\ p_E)$	ecosphere-dependent depletion rate of knowledge
CC	$cc_E + cc_H$	Global carrying capacity in humans per gha.
population	*CC* • *humansphere*	Carrying capacity determines population number.