Supplement 1

Grimm V, Berger U, DeAngelis DL, Polhill JG, Giske J, Railsback SF: „The ODD protocol: a review and first update“

Table S1. Evaluation of 54 publications that use the ODD protocol for describing an individual- or agent-based model. (See text for further explanations).

	Reference	Purpose	State	Process	Design concepts	Initialization	Input	Submodels	Discipline	MS /Appendix	Scheduling	Paramtert table
1	Banitz T, Huth A, Grimm V, Johst K (2008) Clumped versus scattered: how does the spatial correlation of disturbance events affect biodiversity? *Theoretical Ecology* 1: 231-240	OK[1]	OK	OK	[2]Stoch, observ	OK	OK	OK	Ecol	MS[3]	Pseu[4]	Y
2	Beaudouin R, Monod G, Ginot V (2008) Selecting parameters for calibration via sensitivity analysis: An indlividual-based model of mosquitofish population dynamics. *Ecological Modelling* 218: 29-48	OK	OK	OK	Stoch, observ	OK	OK	OK	Ecol	MS	Pseu	Y
3	Best EPH, Boyd WA (2008) A carbon flow-based modelling approach to ecophysiological processes and biomass dynamics of Vallisneria americana, with applications to temperate and tropical water bodies. *Ecological Modelling* 217: 117-131	-[5]	-	-	-	-	-	-	Ecol	-	Flow	-
4	Bithell M, Brasington J (2009) Coupling agent-based models of subsistence farming with individual-based forest models and dynamic models of water distribution. *Environmental Modelling & Software* 24: 173-190	OK	OK	OK	No[6]	OK	OK	OK	Fores	AP[7]	UML[8]	N
5	Blaum N, Wichmann MC (2007) Short-term transformation of	OK	OK	OK	Emerge,	OK	OK	OK	Ecol	AP	Txt[9]	Y

[1] OK: The element is included in the model description using exactly the label required by the ODD protocol and largely following the protocol intentions.
[2] Design concepts: emerge: Emergence; adapt: Adaptation; inter: Interaction; sense: Sensing; stoch: Stochasticity; observ: Observation; collect: Collectives; fit: Fitness; predict: Prediction. Design concepts in brackets: the concept was described without using the concepts name, or a new concept was introduced.
[3] MS: The full model description is included in the manuscript
[4] Pseu: Pseudocode
[5] - : The element is omitted or using a modified label.
[6] No: The element is included, using the right label, but not as intended by the protocol.
[7] AP: The model description is partly or fully included in an Appendix (printed or electronic).
[8] UML: Unified Modeling Language.
[9] Txt: Scheduling described in the text.

	matrix into hospitable habitat facilitates gene flow and mitigates fragmentation. *Journal of Animal Ecology* 76: 1116-1127				adapt, inter, sense, stoch, collect, observe							
6	Brochier T, Lett C, Tam J, Freon P, Colas F, Ayon P (2008) An individual-based model study of anchovy early life history in the northern Humboldt Current system. *Progress in Oceanography* 79: 313-325	OK	OK	OK	Stoch, observ	OK	-	OK	Ocea	Ms	Txt	No
7	Caplat P, Anand M, Bauch C (2008) Symmetric competition causes population oscillations in an individual-based model of forest dynamics. *Ecological Modelling* 211: 491-500	OK	OK	OK	Emerge, stoch, observ	No	OK	OK	Fores	Ms	Txt -	Y Z
8	Caron-Lormier G, Humphry RW, Bohan DA, Hawes C, Thorbek P (2008) Asynchronous and synchronous updating in individual-based models. *Ecological Modelling* 212: 522-527	OK	OK	OK	No	OK	No	No	Ecol	Ms	Txt Fig[10]	N
9	Caron-Lormier G, Bohan DA, Hawes C, Raybould A, Haughton AJ, Humphry RW (2009) How might we model an ecosystem? *Ecological Modelling* 220: 1935-1949	OK	OK	No	Inter, fit, emerge, stoch, (observ)	No	No	No	Ecol	Ms	Txt	Y 4
10	Charles S, Subtil F, Kielbassa J, Pont D (2008) An individual-based model to describe a bullhead population dynamics including temperature variations. *Ecological Modelling* 215: 377-392	OK	OK	OK	Emerge, fit, sens, inter, stoch, observe	OK	OK	OK	Ecol	Ms	Txt Fig	Y
11	Conner MM, Ebinger MR, Knowlton FF (2008) Evaluating coyote management strategies using a spatially explicit, individual-based, socially structured population model. *Ecological Modelling* 219: 234-247	OK	OK	OK	Emerge, sens, stoch, observe, (funct rel.)	OK	-	OK	Ecol	MS	Fig	Y
12	Deygout C, Gault A, Sarrazin F, Bessa-Gomes C (2009) Modeling the impact of feeding stations on vulture scavenging service efficiency. *Ecological Modelling* 220: 1826-1835	OK	No	OK	(Sens), (inter), (observ)	OK	--	OK	Ecol	MS	Fig	Y
13	Dur G, Souissi S, Devreker D, Ginot V, Schmitt FG, Hwang JS (2009) An individual-based model to study the reproduction of egg bearing copepods: Application to Eurytemora affinis (Copepoda Calanoida) from the Seine estuary, France. *Ecological Modelling* 220: 1073-1089	OK	OK	OK	Emerge, fit, sens, inter, stoch, obseve	OK	OK	OK	Ecol	MS	Fig	N
14	Fore M, Dempster T, Alfredsen JA, Johansen V, Johansson D (2009) Modelling of Atlantic salmon (*Salmo salar* L.) behaviour in sea-cages: A Lagrangian approach. *Aquaculture* 288: 196-204	-	OK	-	Sens, stoch, inter, (behav decision)	OK	OK	No	Ecol	MS	-	Y
15	Franz M, Nunn CL (2009) Network-based diffusion analysis: a new method for detecting social learning. *Proceedings of the Royal Society B-Biological Sciences* 276: 1829-1836	OK	OK	OK	-	OK	-	-	Beha v	MS	Txt	N
16	Galvao V, Miranda JGV (2009) Modeling the Chagas' disease after stem cell transplantation. *Physica A-Statistical Mechanics and Its Applications* 388: 1747-1754	OK	OK	OK	Emerge, sens, inter, observe, stoch	OK	No	OK	Biom e	MS	Txt	N
17	Giacomini HC, De Marco P, Petrere M (2009) Exploring community assembly through an individual-based model for trophic interactions. *Ecological Modelling* 220: 23-39	OK	OK	OK	Emerge, sens, inter, stoch, observe	OK	OK	OK	Ecol	MS	Fig	Y

[10] Fig: Scheduling descibed using a figure or diagram.

18	Groeneveld J, Enright NJ, Lamont BB (2008) Simulating the effects of different spatio-temporal fire regimes on plant metapopulation persistence in a Mediterranean-type region. *Journal of Applied Ecology* 45: 1477-1485	OK	OK	OK	Emerge, stoch, observe	OK	No	OK	Ecol	MS	Txt	Y
19	Groeneveld J, Alves LF, Bernacci LC, Catharino ELM, Knogge C, Metzger JP, Pütz S, Huth A (2009) The impact of fragmentation and density regulation on forest succession in the Atlantic rain forest. *Ecological Modelling* 220: 2450-2459	OK	OK	OK	Emerge, inter, stoch, collect, observe,	No	OK	OK	Ecol	MS AP	Txt	Y AP
20	Gusset M, Jakoby O, Müller MS, Somers MJ, Slotow R, Grimm V (2009) Dogs on the catwalk: Modelling re-introduction and translocation of endangered wild dogs in South Africa. *Biological Conservation* 142: 2774-2781	OK	OK	OK	Emerge, inter, stoch, collect, observe	OK	OK	OK	Ecol	MS	Txt	Y
21	Guzy MR, Smith CL, Bolte JP, Hulse DW, Gregory SV (2008) Policy Research Using Agent-Based Modeling to Assess Future Impacts of Urban Expansion into Farmlands and Forests. *Ecology and Society* 13	OK	OK	OK	No	OK	OK	OK AP	Social	MS AP	Fig	N
22	Hellweger FL (2008) The role of inter-generation memory in diel phytoplankton division patterns. *Ecological Modelling* 212: 382-396	OK	OK	OK	Emerge, sens, stoch, collect, observe	OK	OK	OK	Micro biol	MS	Txt	Y
23	Hortal J, Triantis KA, Meiri S, Thebault E, Sfenthourakis S (2009) Island Species Richness Increases with Habitat Diversity. *American Naturalist* 174: E205-E217	OK	OK	OK	Emerge, stoch, inter, observe	OK	OK	OK	Ecol	AP	Code	N
24	Huet S, Deffuant G, Jager W (2008) A Rejection Mechanism in 2D Bounded Confidence Provides More Conformity. *Advances in Complex Systems* 11: 529-549	OK	OK	OK	-	OK	-	-	Social	MS	Code	N
25	Huse G, Ellingsen I (2008) Capelin migrations and climate change - a modelling analysis. *Climatic Change* 87: 177-197	OK	OK	No	Emerge, adapt, fit, predict, sens, inter, stoch, collect, observe	OK	OK	OK	Ecol	MS	Txt -	Y
26	Janssen MA (2009) Understanding Artificial Anasazi. *Jasss-the Journal of Artificial Societies and Social Simulation* 12: A244-A260	-	-	OK	-	-	OK	OK	Arche	MS	Txt -	Y -
27	Jovani R, Grimm V (2008) Breeding synchrony of colonial birds: from local stress to global harmony. *Proceedings of the Royal Society B-Biological Sciences* 275: 1557-1563	OK	OK	OK	Emerge, adapt, sens, stoch, observe	OK	OK	OK	Beha vior	MS	Txt	N
28	Kochy M, Mathaj M, Jeltsch F, Malkinson D (2008) Resilience of stocking capacity to changing climate in arid to Mediterranean landscapes. *Regional Environmental Change* 8: 73-87	-	OK	OK	-	-	-	OK	Ecol	MS	Fig	Y incom
29	Kramer-Schadt S, Fernández N, Grimm V, Thulke H-H (2009) Individual variation in infectiousness explains long-term disease persistence in wildlife populations. *Oikos* 118: 199-208	-	OK	OK	(emerge), stoch	OK	OK	OK AP	Epidem	MS AP	Txt, Fig	Y AP
30	Kristiansen T, Jorgensen C, Lough RG, Vikebo F, Fiksen O (2009) Modeling rule-based behavior: habitat selection and the growth-survival trade-off in larval cod. *Behavioral Ecology* 20: 490-500	OK	-	No	-	-	No	OK	Behav	MS	-	N

31	Kristiansen T, Lough RG, Werner FE, Broughton EA, Buckley LJ (2009) Individual-based modeling of feeding ecology and prey selection of larval cod on Georges Bank. *Marine Ecology-Progress Series* 376: 227-243	OK	OK	OK	Emerge, sens, inter, stoch, observe	OK	OK	OK	Ecol	MS	Txt	N
32	Le Fur J, Simon P (2009) A new hypothesis concerning the nature of small pelagic fish clusters An individual-based modelling study of Sardinella aurita dynamics off West Africa. *Ecological Modelling* 220: 1291-1304	OK	OK	OK	Emerge, adapt, fit, inter, sens, stoch, collect, observe	OK	OK	OK	Ecol	MS	Fig	Y
33	Le Maitre DC, Krug RM, Hoffmann JH, Goydon AJ, Mgidi TN (2008) Hakea sericea: Development of a model of the impacts of biological control on population dynamics and rates of spread of an invasive species. *Ecological Modelling* 212: 342-358	OK	OK	OK	Emerge, sens, inter, stoch, observ	OK	OK	OK	Ecol	MS	Txt	Y
34	Lee SH, Bardunias P, Su NY (2008) Two strategies for optimizing the food encounter rate of termite tunnels simulated by a lattice model. *Ecological Modelling* 213: 381-388	-	OK	No	Emerge, sens, inter, stoch	-	-	No	Behav	MS	-	N
35	Lett C, Verley P, Mullon C, Parada C, Brochier T, Penven P, Blanke B (2008) A Lagrangian tool for modelling ichthyoplankton dynamics. *Environmental Modelling & Software* 23: 1210-1214	OK	OK	OK	Stoch, observe	OK	OK	OK	Ecol	MS	Txt	N
36	Linard C, Poncon N, Fontenille D, Lambin EF (2009) A multi-agent simulation to assess the risk of malaria re-emergence in southern France. *Ecological Modelling* 220: 160-174	OK	OK	OK	Observe, sens, inter, stoch	OK	OK	OK	Epidem	MS	UML	Y
37	Meyer KM, Wiegand K, Ward D, Moustakas A (2007) SATCHMO: A spatial simulation model of growth, competition, and mortality in cycling savanna patches. *Ecological Modelling* 209: 377-391	OK	OK	OK	Emerge, stoch, observe	OK	OK	OK	Ecol	MS	Fig	Y
38	Meyer KM, Vos M, Mooij WM, Hol WHG, Termorshuizen AJ, Vet LEM, van der Putten WH (2009) Quantifying the impact of above- and belowground higher trophic levels on plant and herbivore performance by modeling. *Oikos* 118: 981-990	OK	OK	OK	Emerge, sens, inter, stoch, observe	OK	OK	OK	Ecol	MS AP	Fig	Y
39	Mirabet V, Freon P, Lett C (2008) Factors affecting information transfer from knowledgeable to naive individuals in groups. *Behavioral Ecology and Sociobiology* 63: 159-171	OK	OK	OK	Emerge, sens, inter, stoch, collect, observe	OK	No	-	Behavior	MS	Txt	Y
40	Müller B, Linstädter A, Frank K, Bollig M, Wissel C (2007) Learning from local knowledge: modeling the pastoral-nomadic range management of the Himba, Namibia. *Ecological Applications* 17: 1857-1875	OK	OK	OK	-	OK	-	OK	Ecol	MS	Txt	Y
41	Pagel J, Fritzsch K, Biedermann R, Schröder B (2008) Annual plants under cyclic disturbance regimes: Better understanding through model aggregation. *Ecological Applications* 18: 2000-2015	OK	OK	OK	(stoch), inter	OK	OK	OK	Ecol	MS	Txt	Y
42	Paruelo JM, Pütz S, Weber G, Bertiller M, Golluscio RA, Aguiar MR, Wiegand T (2008) Long-term dynamics of a semiarid grass steppe under stochastic climate and different grazing regimes: A simulation analysis. *Journal of Arid*	OK	-	No	-	-	-	- AP	Ecol	MS	-	Y AP

	Environments 72: 2211-2231											
43	Piou P, Berger U, Hildenbrandt H, Grimm V, Diele K, D'Lima C (2007) Simulating cryptic movements of a mangrove crab: recovery phenomena after small scale fishery. *Ecological Modelling* 205: 110-122	OK	OK	OK	Emerge, inter, stoch, observe	OK	OK	OK	Ecol	MS	Txt	Y
44	Preuss TG, Hammers-Wirtz M, Hommen U, Rubach MN, Ratte HT (2009) Development and validatlion of an individual based Daphnia magna population model: The influence of crowding on population dynamics. *Ecological Modelling* 220: 310-329	OK	OK	OK	Emerge, adapt, sens, inter, stoch, observe	OK	-	OK	Ecol	MS	Code	Y
45	Rinke K, Petzoldt T (2008) Individual-based simulation of diel vertical migration of Daphnia: A synthesis of proximate and ultimate factors. *Limnologica* 38: 269-285	OK	OK	OK	Emerge, sens, stoch, observe, (spatial representation)	OK	OK	OK	Ecol	MS Ap	Fig	Y
46	Schmolke A (2009) Benefits of dispersed central-place foraging: An individual-based model of a polydomous ant colony. *American Naturalist* 173: 772-778	OK	OK	OK	Emerge, adapt, sens, inter, stoch, collect, observe	OK	-	OK	Beha ve	AP	Fig	Y
47	Stillman RA (2008) MORPH - An individual-based model to predict the effect of environmental change on foraging animal populations. *Ecological Modelling* 216: 265-276	OK	OK	OK	Emerge, adapt, fit, predict, inter, sens, stoch, collect, observe	OK	No	OK	Ecol	MS	Fig	Y
48	Strand E, Huse G (2007) Vertical migration in adult Atlantic cod (Gadus morhua). *Canadian Journal of Fisheries and Aquatic Sciences* 64: 1747-1760	OK	OK	OK	Adapt, emerge, sens, inter, stoch, observe	OK	OK	OK	Ecol	MS	Fig	Y
49	Swanack TM, Grant WE, Forstner MRJ (2009) Projecting population trends of endangered amphibian species in the face of uncertainty: A pattern-oriented approach. *Ecological Modelling* 220: 148-159	OK	OK	OK	(emerge), sens, inter, stoch, observe	OK	-	OK	Ecol	MS	Fig	Y
50	van Nes EH, Noordhuis R, Lammens EHHR, Portieje R, Reeze B, Peeters ETM (2008) Modelling the effects of diving ducks on zebra mussels Dreissena polymorpha in lakes. *Ecological Modelling* 211: 481-490	OK	OK	OK	Emerge, adapt, fit, inter, stoch, (collect)	OK	OK	OK	Ecol	MS AP	Fig	Y
51	Wang M, Grimm V (2007) Home range dynamics and population regulation: An individual-based model of the common shrew *Sorex ayaneus*. *Ecological Modelling* 205: 397-409	OK	OK	OK	Sens, adapt, fit, inter, stoch, observe	OK	OK	OK	Ecol	MS	Pseu	Y
52	Warren J, Topping CJ, James P (2009) A unifying evolutionary theory for the biomass-diversity-fertility relationship. *Theoretical Ecology* 2: 119-126	OK	OK	OK	Emerge, adapt, fit, predict, sens, stoch, collect, observe	OK	OK	-	Ecol	AP	Txt Pseu	-
53	Willis J (2008) Simulation model of universal law of school size	OK	OK	OK	Sens, inter,	OK	OK	No	Ecol	MS	Txt	N

	distribution applied to southern bluefin tuna (Thunnus maccoyii) in the Great Australian Bight. *Ecological Modelling* 213: 33-44				collect							
54	Yniguez AT, Mcmanus JW, DeAngelis DL (2008) Allowing macroalgae growth forms to emerge: Use of an agent-based model to understand the growth and spread of macroalgae in Florida coral reefs, with emphasis on Halimeda tuna. *Ecological Modelling* 216: 60-74	-	OK	OK	Emerge, sens, inter, stoch, collect, observe	OK	OK	OK	Ecol	MS	Fig	Y

Purpose OK: 47 = 87% Omitted: 7 =13% Wrong: 0
State variables and scales OK: 49 = 91% Omitted: 4 = 7% Wrong: 1 = 2%
Process overview and scheduling OK: 47 = 87% Omitted: 2 = 4% Wrong: 5 = 9%
Design concepts: 43 = 79% Omitted: 8 = 15% Wrong: 3= 6%
Initialization OK: 45 = 83% Omitted: 6 = 11% Wrong: 3= 6%
Input OK: 34 = 63% Omitted: 13 = 24% Wrong: 7= 13%
Submodels OK: 43 = 80% Omitted: 6 = 11% Wrong: 5= 9%

Design concepts (occurrence in 43 papers that address Design concepts)
Emergence: 33 = 76%
Adaptation: 11 = 25%
Fitness: 9 = 20%
Prediction: 3 = 7%
Sensing: 28 = 65
Interaction: 28 = 65
Stochasticity: 40 = 93%
Collectives: 13 = 30%
Observation: 37 = 86%

Disciplines

Ecology: IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIII		38
Epidemiology: II		2
Social: II		2
Archeology: I	1	
Microbiology: I	1	
Biomedical: I	1	
Behavior: IIIII I	6	
Forest Science: II		2
Oceanography: I		1

Of the 54 publications liste in Table S1 we would like to emphasize the following papers as particularly good examples to follow: Banitz et al. (2008), Beaudouin et al. (2008), Blaum and Wichmann (2007; see supplementary data), Charles et al. (2008), Dur et al. (2009), Giacomini et al. (2009), Gusset et al. (2009), Hellweger (2008), Jovani and Grimm (2008), Kristiansen et al. (2009), Le Fur and Simon (2009), Meyer et al. (2007; 2009, see supplementary data), Pagel et al. (2008), Piou et al. (2007), Strand and Huse (2007), Van Nes et al. (2008).