Model	Perspective	Strengths	Weaknesses	Opportunities	Challenges
RangeShifter	EXPERT	• Flexible platform combining several demographic and dispersal models within a user-friendly framework. Suitable for both theoretical and applied models. • Comprehensive manual and tutorials. • As an individual-based model, variation between individuals in dispersal behaviours can be included, and their eco-evolutionary dynamics investigated. • The mechanistic dispersal model SMS allows for dispersal through heterogeneous landscapes.	• Complex models require many parameters, which can interact in ways which are not always immediately obvious. • Requires programmer support, and thus cannot be adapted by users to add functionality. • Explicit climate dependencies not yet incorporated.	• Dynamic landscapes and more flexible implementation of variable dispersal traits and their underlying genetics to come in version 2 • Potential to couple with socio-economic land-use models to implement dynamic models of environmental change.	• Obtaining parameter estimates for applied models of real species • Understanding how climate variability (i.e. weather) affects key demographic and dispersal processes.
	PARTICIPANT	• GUI (graphical user interface) • Good for assessing 'what if situations' • Easy to use, once understood • Relatively few simple inputs that allow large flexibility, producing lots of info from output • Lots of options • Mechanistic, individual based • Simple, focused • Use of SMS, seems to make the movement models more robust • Spatially explicit • Stochastic • Refined variables • Possibility of running sensitivity analyses • Establishes framework for repeatability	• Large datasets • Parameter choice is subjective • Requires a lot of ecological knowledge about species -> using best-guess scenarios may not be reliable for decision-making • Single species, no interspecies interactions • Computationally intensive (stochasticity) • Expensive on output • Would a statistical analysis need to produce so much data? • Lack of dynamic landscapes • No uncertainty estimates • Interface not very clear • Reduced number of feedback processes between environment and species, difficult to model additional processes and dynamics	• Real life species, real life situations e.g. conservation priorisation and management • Incorporating genetic relatedness of many individuals dispersing together (e.g. seeds with animal dispersers) • Incorporating land use change • Look at how a species would behave in a certain environment, then comparing with real data to understand the effect of competition • Set a modelling standard to cross-compare studies	• Cross-model comparison difficult within programme • Availability of data for parameters, particularly dispersal • Hard to learn • Classifying dynamic landscapes • Multispecies competition, e.g. invasion and community assembly • Getting appropriate parameters when using SMS • Sensitivity might be an issue • Make it more relevant for plant movement • Plugging external models as components to e.g. reproduce feedbacks • Platform for coupling models
Condatis	EXPERT	• Flexible and powerful application which is quick and easy to use • Tool for landscape scale studies of directional connectivity over successive generations of species • Can pick out the most effective sites for habitat creation, test climate change resilience or run a number of directly comparable colonisation scenarios • Works particularly well for habitats that are well-defined and patchy and at a scale that will require several generations to colonise • Can work with habitat coverage map and little data on species' traits.	• Movement is considered between source and target, multidirectional movement requires user to run multiple specifications • If the area of interest is very small (roughly the distance required to colonise habitat within one generation) then results are unlikely to be meaningful • Assumes all cells in the matrix between habitat patches to be of uniform quality.	• Can be used to prioritise sites for restoration based on maximising improvements in connectivity via the least number or least cost sites • Potential to link with climate envelope models, climate change projections, ecosystem service models… • Could be developed into a web application • More nuances of species' life history, dispersal and gradations of habitat quality could be developed.	• Species specific parameters may not be known • Preparation of input data requires GIS knowledge.

	PARTICIPANT	• Seems quick and easy • Simple, answers one question • Prioritisation • Not a large data requirement e.g. regarding species • Large-scale • Policy-oriented • Climate change relevance • Support decision-making at strategic large scales • Easy to use, could be used by stakeholders • Graphical • Idea of flow and ecological conductance, easily interpretable theory • Large scales shows the effects of interventions	• One habitat type, one species, one metric of benefit • Limited to questions of connectivity • Need good quality landscape data • Doesn't include habitat mortality estimates, e.g. crossing a road in the matrix may have higher risk than farmland • Demands to prioritise a lot • Unidimensional output • One point, one target • Slow at higher than 20 tc grid	• Helping develop corridors for conservation • Helping predict movement of populations with changing climate • Build and integrate with a spatial optimization between different present habitats • Already being used by some NGOs • It has an intuitive interface, so will probably be used widely • Has it been validated? • Combine with multiple GIS layers • Interesting dissertation project	• Multiple interaction and their interaction, especially considering that the artificial construction of one habitat might destroy another • Promote it so becomes widely used • Different species might not be resilient to climate change, which means policy oriented measures for a number of species might have negative impact on other ones • Incorporating different layers of spatial data • Limited to one habitat types • Will it present enough info to be useful?
FEARLUS-SPOMM	EXPERT	• Flexible and highly-configurable simulation environment • Agents (representing land-based businesses) use cognitively-plausible decision-making algorithm (case-based reasoning (CBR) 'lite') • Heuristic algorithms for decision-making optional • Reasonably well published / established model (and submodels) • Explicit simulation of policy agent • Complex dynamics of species and social spaces can be captured • Species interactions can be configured • Extensible if you have the coding expertise • Open source and freely available	• With great flexibility comes great numbers of parameters, switches, buttons and dials • Built on unsupported ObjC-Swarm, the installation of which is not a trivial exercise • Not at all user friendly (even with the documentation -- there are manuals) and won't ever be so • When using CBR, agents need time to learn -- this can affect dynamics and make experiments difficult to set up	• Can explore various options for managing biodiversity in a landscape through incentivisation of land managers • Versions of the code exist (but have not yet been used professionally) allowing more functionality (e.g. feedback from species occupancy to yields, uncertainty in yields, XML output). • Sufficiently configurable that climate change and species migration scenarios could be explored	• Programming expertise typically needed even to configure a run • Configuring a run requires a lot of thought before the scripts to set it up are written • Data to configure empirical cases typically lacking • Analysing the output from the model is challenging due in part to the potential volume of it, but also to the multiple types it has
	PARTICIPANT	• Adds human dimension to ecological models • Complex and specific • Implements behavioural aspects ABM in general: • Highly versatile • A lot of support and history of use • JASSS journal • Good for various simulations of human decision-making • Sensible approach to modelling human behaviour • Explicit assumptions • Seemingly the best expert method to model and verify human interactions • Heterogeneity • Feedback • Time dependency • Emerging patterns • Ability to model complex systems • Powerful predictor integrating society and environment	• Human dimension-making difficult to represent • Human behaviour and morals - money may not be main driver for a decision • Potential complexity and difficulty for non-programmers ABM in general: • Confidence in output • Connection between ABM and theory • Dynamics/interactions are poorly understood - poorly modelled? • The models appear to be largely abstracted from reality due to the limited access to high quality empirical data. This makes it difficult to trust the result. • What are the variables of interest? • How complex is too complex? • Need lots of training and skills in e.g. programming	• Input social science theory in environmental modelling • Cross-disciplinary, brings research together • Better ways of taking into account human impact in ecology and conservation efforts • Understand means e.g. incentivising farmers to promote biodiversity ABM in general: • Flexibility between disciplines, so incorporating social science • Model assumptions can be easily verified and rejected • Huge opportunities to increase interdisciplinary communication, if social scientists, ecologists and modellers can be brought to the same table • Simulations -> huge datasets • Emergence • Mix qualitative and quantitative • Mix disciplines, e.g. ABM models and connectivity studies for conservation	• Empirical data availability • Coupling itself is difficult • A lot of data needed for validation • Generally, fit to data not only measure of validation -> context dependent • Deciding which factors to not include in agents' decision-making processes ABM in general: • Obtaining data for empirical ABM • Designing code for emotion and opinion • Fit to data vs. ontology • Social science is not well executed and explained for ABM incorporation • How to increase social science appetite for understanding ABMs (better explanation in journal articles? strategic partnerships and training?) • Models and social scientists speaking different language, no common ground • Describing the system dynamics and processes is not easy and well formalised • Summarising info • Explaining reasoning behind it and following protocols