Supporting Information

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Table S1. Social and ecological factors and drivers of change identified during conceptual model development

Case study	Ecosystem features and processes	Social factors	Drivers	Scenarios explored	Models and input data used, as well as impact analysis method; for details on calibration and refinements, see ref. 1
1: Flood on a lakeside urban plain	Soil type and condition, topography, geology, estuary berm height, lake water levels, infiltration, storage, run-off, estuary flows	Elevation of infrastructure, location of infrastructure, forestry area and management, value of assets, insurance claims, infrastructure damage costs	Rainfall and temperature, vegetation cover and condition, invasive nonnative plant spread, wildfire, estuary mouth changes, forestry clearing practices	Baseline: current land cover and climate Moderate: clear-felling and nonreplanting of the plantation, current climate Severe: burning down of the plantation by a severe wildfire with replacement by degraded fynbos, current climate Climate change: current land cover, future climate	Agrohydrological modeling system used to simulate daily flows (2) Soils and vegetation data (3) Thirty-meter resolution land cover data (4) Daily temperature data: current (1961–1990) and future (2021-2050) from regional climate model (CCAM) (5) Daily rainfall data for the same periods (6) Exceedance probabilities for extreme flows from the simulated flow record calculated with the Log Pearson III distribution (7)
2: Wildfire in a rapidly developing area	Vegetation type and distribution, fire weather (temperature, wind, humidity), landscape structure, lightning	Population density, road network, fire breaks, exposed wildland–urban interface, firefighting resources and distance, prescribed burning regimes, exposed flammable infrastructure and assets, fire regulations	Spread of invasive nonnative vegetation, change in flammable vegetation, increases in ignition sources, climate change, human population growth, road network changes, fragmentation of urban edge	Baseline: nonnative trees and shrubs cleared and maintained at levels below 5% cover, current climate Moderate: current levels of invasion by nonnative trees, current climate Severe: nonnative trees invade to maximum potential, current climate Climate change: nonnative trees and shrubs are cleared and maintained at levels below 5%, future climate	Equation to estimate changes in fireline intensity across 106 spatial assessment units (8, 9) McArthur's Forest Fire Danger Index (10) to estimate rates of fire spread Data on nonnative invasive plant distribution and spread rates (*Pinus* and *Hakea* species) (11–13) Daily data temperature, wind speed, rainfall, and relative humidity from CCAM (5) for periods as for flood study

Table S1. Cont.

Case study	Ecosystem features and processes	Social factors	Drivers	Scenarios explored	Models and input data used, as well as impact analysis method; for details on calibration and refinements, see ref. 1
3: Drought and hops production	Soil, landcover, run-off, ground water recharge, geology, topography, sedimentation, evaporation,	Ground water abstraction, dam infrastructure, boreholes, location of farms, labor and input costs, market, labor movements	Nonnative invasive plant spread, rainfall changes, landcover change, increases in surface and groundwater abstraction	Baseline: indigenous natural vegetation with no invasive nonnative trees, current climate Moderate: nonnative trees invade to maximum potential impacts measured as effects on low flow drought intensity (70% probability of exceedance), current climate Severe: nonnative trees invade to maximum potential impacts measured as effects on very low flow drought intensity (90% probability of exceedance), current climate Climate change: indigenous natural vegetation with no invasive nonnative plants or human activities, future climate	Flow simulations used to develop flow duration curves were derived using the Pitman model (14) Data on soil depths, soil texture, topographic slope, and subsurface geological conditions extracted from agricultural land types database www.agis.agric.za An ecological module estimated invasive nonnative tree water use (15), which links back to the Pitman model to predict changes in streamflow Monthly temperature and rainfall data from CCAM (5) for periods as for flood study with modifications in (1) Changes in flow compared using flow duration curves, focusing on flows produced at >70% and >90% exceedance range
4: Storm-waves on an urbanized coast	Wave power and height, wave run-up, geomorphology, elevation, erosion potential, height of foredune, sea water level, sediment transport, sea storms, protection from prevailing wave energy	Distance of nearest infrastructure to shore, shoreline management, beach maintenance, dredging, ensured assets, insurance claims, provincial damage reports	Sea level rise, erosion, coastal hardening, land cover change, foredune height change, wind, tides	Baseline: current beach slope, current climate Moderate: 3° increase in beach slope, current climate Severe: 6° increase in beach slope, current climate Climate change: current beach slope, future climate	Numerical wave model (16) to translate offshore wave data to inshore wave conditions Wave run-up model (17) to calculate wave run-up elevations at 0.5 km points along the coastline Data on wave height, period, and direction, from the National Centre for Environmental Prediction (NCEP) [www.nco.ncep.noaa.gov/pmb/products/wave/#WW3ENS] Beach and inshore slopes from the South African Navy's bathymetric charts Future sea-level projections from ref. 18, and offshore extreme waves from metocean climate modeling (19)

The table also lists scenarios, models, and input data sources used. CCAM, conformal-cubic atmospheric model.

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