Supplement 3: Example Applications of the Modified B-S Formula for Climate-related Decisions

Case	*Need*	*Ecosystem Service*	*Operational Tipping Point*	*Payoff (or equivalent in B-S)*	*Hedging Strategy*
NT Ice Roads	Supplies at mines	Cold producing lake ice	Enough fuel, concrete & prill	Truck transport vs. air	Plowing; storage on site
California Drought	Water	Sierra snow pack amount	Enough to irrigate crops	Water supplied locally vs. imported	Dam (i.e., water storage)
Kenya Crop Insurance	Encourage farmers to grow crops	Precipitation amount & seasonal pattern	Assurance against financial loss	Premiums vs. payouts	Plant alternative crops
Point Thomson Gas	Supplies at the gas fields	Ice road season length/sea ice state	Sufficient goods and materials	Truck vs. barge costs	Storage on site
Northern Sea Route (NSR)	Facilitate Europe - Asia trade	Open water season length	Voyages	NSR vs. Suez Canal	Ice-strengthened ships or icebreakers

*Key: **Need** is the purpose for which goods or services are used. **Climate Parameters** are the underlying climatic variables in the time series. **Supply** is the way nature (through the climate) meets the need. **Demand** is the quantity required. The **Operational threshold** is when supply equals demand (ratio=1.0). Above the operational threshold, there is excess capacity (supply > demand) and no additional costs are incurred. Below the operational threshold (supply < demand), an alternate method, often costing more or requiring more work, is required to meet the demand. At the OPT, costs switch from the lower priced system to the more expensive system; the difference between the two gives a **Marginal Cost Differential**. **Hedging Strategy** is an approach used to reduce variance in the system.*