Supplementary Material

Robust strategies for forest wildfire mitigation under uncertainty

A : Contiguity constraint

For the formulation of the contiguity constraint after (Shirabe, 2005) the forest units are transformed to a network, where each unit is a node and every node gets assigned a set of neighboring nodes. Here, the Queen's adjacency is used to define the neighborhoods of forest units. Additionally, the unit area sizes are obtained. With this information and the identifier of the particular unit for which a contiguous patch is sought for, the contiguous patch is built iteratively (Algorithm 1). The contiguity constraint is implemented and illustrated at Mendeley Data.

Algorithm 1 Contiguous patch creation

Require: Set of nodes attributed with unit IDs, unit area sizes and sets of queen adjacent neighbor units
Require: Unit ID for which a contiguous patch is sought for
$node \leftarrow$ Selected node ID
$f \leftarrow 0$
$phi \leftarrow \emptyset$
$Ni \leftarrow$ Neighbor nodes of selected Unit ▷ Candidate List
while $f < T$ **do**
  $phi \xleftarrow{+} node$
  $k \leftarrow$ Nodes in Ni
  $k \leftarrow k$sorted ascending by area
  if $f + k[0].Area \leq T$ **then**
    $node \leftarrow k[0].ID$ ▷ Get first node
    $Ni \xleftarrow{-} node$ ▷ Remove from NI
    $Ni \xleftarrow{+}$ Neighbor units of current node
    $Ni \xleftarrow{-} phi \cap Ni$ ▷ remove nodes from Ni if they are already in phi
    $f \leftarrow f + node.Area$
  end if
end while
Return phi ▷ Return phi with unit IDs that form contiguous patch

B: LandClim Simulation

LandClim is a forest landscape model to simulate long-term forest dynamics with spatial explicit input data (Schumacher et al., 2004) being elevation, aspect, slope, soil water-holding capacity, management, land type and monthly climate. The various simulation parameters not mentioned in Sections 3.3 and 7.1 were kept as default values from LandClim.

Table B: Native species parameters used in the LandClim landtype configuration.

Name	Grass	Pinus ponderosa	Pinus jeffreyi	Calocedrus decurrens
Max age	10	700	700	933
Shade tolerance	1	2	2	4
Fire tolerance	3	4	4	5
Windthrow tolerance	3	3	3	1
RMax	1.0	0.13	0.13	0.2
KMax	128	14	14	10
Foliage type	1	3	3	3
Min Degree days	200	1200	1200	850
Min temperature	-99	-12	-12	-34
Drought tolerance	0.33	0.23	0.4	0.6
Browsing tolerance	3	1	1	1
Crown shape	2	4	4	4

Name	Pinus cembroides	Calocedrus decurrens	Pseudotsuga menziesii	Quercus kelloggii
Max age	1050	800	700	500
Shade tolerance	3	1	3	1
Fire tolerance	4	3	3	2
Windthrow tolerance	3	1	1	2
RMax	0.03	0.016	0.08	0.01
KMax	5.9	16	11.2	1.7
Foliage type	5	4	3	1
Min Degree days	323	900	800	700
Min temperature	-11	-12	-15	-20
Drought tolerance	0.23	4	0.17	0.08
Browsing tolerance	2	2	2	3
Crown shape	4	4	3	2

The digital elevation model is retrieved from NASA Earthdata (NASA JPL, 2022), and the aspect and slope are derived from the elevation.

The monthly climate is modelled in LandClim with retrieved information from (USAFacts, 2022), containing monthly temperature means and standard deviations, precipitation means and standard deviations, as well as the trend from year 1900 to today. The information in Table B about native species and their attributes was collected and estimated with Burns & Honkala (1900) and Calflora (2022).

The soil water-holding capacity, i.e. bucket size, is estimated after Henne et al. (2011) with the available water capacity (AWC), the coarse fragment content (CWC), and the soil depth (D) with soil input data for *D*, *AWC*, and *CWC* obtained from ISRIC SoilGrids (Hengl et al., 2017):

$$Bucketsize = \frac{D * AWC * \frac{1-CFC}{100}}{10} \quad \text{(A1)}$$

where
AWC : available water content the soil can hold in *mm* per *m*,
CWC : coarse fragment content in percentage of volume,
D : soil depth in *m*.