

Supplementary Materials

Table S1. Description of stocks, flows, and converters (variables and constants) of the WALFORM model (sorted alphabetically). Column AGG indicates if data are aggregated (+), specified by group of species (G), or by type of species (T).

Name	Description	Unit	AGG
STOCKS (13)			
ASSIM HARDW	Amount of hardwood (regional + import) processed by industries	m ³	T
ASSIM SOFTW	Amount of softwood (regional + import) processed by industries	m ³	T
PRIOR TIMB	Amount of timber sold before the storm and not yet harvested	m ³	G
ROUNDWOOD	Amount of roundwood transported to industries	m ³	G
STORAGE	Amount of windfalls on storage terminals	m ³	G
TIMB HARV	Amount of timber to harvest (timber sold)	m ³	G
TIMB SALE	Amount of timber on sale	m ³	G
TIMB TRANSP	Amount of timber to transport (harvested) out of forests	m ³	G
TRANSF HARDW	Amount of regional hardwood in industries	m ³	T
TRANSF SOFTW	Amount of regional softwood in industries	m ³	T
WIND HARV	Amount of windfalls to harvest (windfalls sold + exchanged)	m ³	G
WIND SALE	Amount of windfalls on sale	m ³	G
WIND TRANSP	Amount of windfalls to transport (harvested) out of forests	m ³	G
FLOWS (18)			
Exp hardw	Export capacity (hardwood)	m ³ /month	T
Exp softw	Export capacity (softwood)	m ³ /month	T
Hardw	Amount of regional hardwood arriving to industries	m ³ /month	T
Hc prior	Harvesting capacity (prior timber)	m ³ /month	G
Hc timb	Harvesting capacity (timber)	m ³ /month	G
Hc wind	Harvesting capacity (windfalls)	m ³ /month	G
Ic hardw	Industrial capacity (hardwood)	m ³ /month	T
Ic softw	Industrial capacity (softwood)	m ³ /month	T
Imp hardw	Import capacity (hardwood)	m ³ /month	T
Imp softw	Import capacity (softwood)	m ³ /month	T
In timb	Amount of timber put on the market	m ³ /month	G
Pc timb	Purchase capacity (timber)	m ³ /month	G
Pc wind	Purchase capacity (windfalls)	m ³ /month	G
Softw	Amount of regional softwood arriving to industries	m ³ /month	T
Tc destock	Transport capacity of windfalls (terminals to industries)	m ³ /month	G
Tc stock	Transport capacity of windfalls (forests to terminals)	m ³ /month	G
Tc timb	Transport capacity of timber (forests to industries)	m ³ /month	G
Tc wind	Transport capacity of windfalls (forests to industries)	m ³ /month	G

Table S1. Cont.

Name	Description	Unit	AGG
CONVERTERS (61)			
dam mob	Share of storm damage put on the market	%	+
damage	Amount of storm damage (assessed at the regional level)	m ³	+
delay pay	Activation of payment delays (Yes or No)	-	+
demand	Variation in market demand for regional resources (per year)	%	G
diff harv	Differential of harvesting productivity in wind-damaged areas	%	+
diff imp	Differential of importation (positive or negative, per year)	%	T
dist store	Mean distance of transport for storage	km	+
ex hardw	Hardwood exported per month	m ³	T
ex prior hardw	Priority to hardwood export during crisis period (Yes or No)	-	T
ex prior softw	Priority to softwood export during crisis period (Yes or No)	-	T
ex soft	Softwood exported per month	m ³	T
exch rate	Exchange rate between windfalls and timber	%	+
fuel cap	Industrial demand for fuel wood	m ³	T
h work	Hours worked per year per truck driver	h	+
harv delay	Harvesting delays (for timber sold before the storm)	month	+
harv rate	Share of timber sold before the storm already harvested	%	+
harv syst	Harvesting systems (share between manual, mechanized and mixed)	%	+
harvesters	Number of harvesters available	-	+
hc inaccess	Mean inaccessibility of forest roads (per month of the year)	%	+
hc ratio wind	Share of harvesting capacity dedicated to windfalls	%	+
hc share wind	Share of harvesting capacity by type of species (windfalls)	%	G
hc tot	Maximal harvesting capacity	m ³ /month	+
hc tot timb	Maximal harvesting capacity for timber	m ³ /month	+
im hardw	Level of importation (hardwood)	m ³ /month	T
im softw	Level of importation (softwood)	m ³ /month	T
load unload	Time for loading and unloading trucks	h	+
man prod	Productivity of manual harvesting system (per workers)	m ³	+
mean density	Average density of wood loading	t/m ³	+
mean dist	Mean distance of transport from forests to industries	km	+
mean speed	Average truck speed	km/h	+
mec prod	Productivity of mechanized harvesting system (per harvester)	m ³	+
mma	Maximum mass authorized for trucks	t	+
nb trucks	Total number of trucks available	-	+
offer	Share of usual timber supply sold (positive or negative, per year)	%	G
panel cap	Industrial demand for panelling	m ³	T
pay delay	Payment delays (for timber sold before the storm)	%.month	+
pc ratio wind	Share of purchase capacity dedicated to windfalls	%	+
pc share wind	Share of purchase capacity by type of species (windfalls)	%	G
pc tot	Maximal purchase capacity	m ³ /month	+
price init	Mean stumpage prices before the storm	€/m ³	G
pulp cap	Industrial demand of pulpwood	m ³	T
red prod	Industrial productivity variation (positive or negative)	%	+
saw cap	Industrial demand for sawing	m ³	T
skidders	Number of harvesters available	-	+

Table S1. Cont.

Name	Description	Unit	AGG
stock	Amount to store (maximal value)	m ³	G
tare weight	Weight of the truck without loading	t	+
tc inaccess	Inaccessibility of forest roads (per month of the year)	%	+
tc ratio wind	Share of transport capacity dedicated to windfalls	%	+
tc share wind	Share of purchase capacity by type of species (windfalls)	%	G
timb dev	Devaluation of timber stumpage prices due to the storm	%	G
timb price	Timber stumpage prices after the storm	€/m ³	G
timb to pay	Amount of money to pay for timber sold before the storm	€	+
tr fact	Truck productivity factor	m ³ /km.t.truck	+
trucks rep	Share of transport capacity dedicated to storage operations	%	+
trucks wind	Number of trucks dedicated to windfalls transportation	-	+
vol timb init	Amount of timber sold before the storm	m ³	G
vol timb norm	Average amount of timber sold per year	m ³	G
wind dev	Devaluation of windfalls stumpage prices (first year)	%	G
wind dev supp	Devaluation of windfalls stumpage prices (after one year)	%	G
wind price	Windfalls mean stumpage prices	€/m ³	G
workforce	Number of fellers available	-	+

Table S2. Equations used in the WALFORM model.

For t = 0 (initial value)	
STOCKS (t)	
[S1]	WIND SALE = damage × dam mob
[S2]	TIMB SALE = 0
[S3]	WIND HARV = vol timb init × (1 - harv rate) × exch rate
[S4]	TIMB HARV = 0
[S5]	PRIOR TIMB = vol timb init × (1 - harv rate) × (1 - exch rate)
[S6]	WIND TRANSP = 0
[S7]	TIMB TRANSP = 0
[S8]	ROUNDWOOD = vol timb init × harv rate
[S9]	STORAGE = 0
[S10]	TRANSF HARDW = 0
[S11]	TRANSF SOFTW = 0
[S12]	ASSIM HARDW = 0
[S13]	ASSIM SOFTW = 0

Table S2. Cont.

For t = 1 to 60 and dt = 1	
STOCKS (t)	
[S14]	WIND SALE (t) = WIND SALE (t - 1) - Pc wind (t - 1)
[S15]	TIMB SALE (t) = TIMB SALE (t - 1) + In timb (t - 1) - Pc timb (t - 1)
[S16]	WIND HARV (t) = WIND HARV (t - 1) + Pc wind (t - 1) - Hc wind (t - 1)
[S17]	TIMB HARV (t) = TIMB HARV (t - 1) + Pc timb (t - 1) - Hc timb (t - 1)
[S18]	PRIOR TIMB (t) = PRIOR TIMB (t - 1) - Hc prior (t - 1)
[S19]	WIND TRANSP (t) = WIND TRANSP (t - 1) + Hc wind (t - 1) - Tc wind (t - 1) - Tc stock (t - 1)
[S20]	TIMB TRANSP (t) = TIMB TRANSP (t - 1) + Hc prior (t - 1) + Hc timb (t - 1) - Tc timb (t - 1)
[S21]	ROUNDWOOD (t) = ROUNDWOOD (t - 1) + Tc timb (t - 1) + Tc wind (t - 1) + Tc destock (t - 1) - Exp hardw (t - 1) - Exp softw (t - 1) - Hardw (t - 1) - Softw (t - 1)
[S22]	STORAGE (t) = STORAGE (t - 1) + Tc stock (t - 1) - Tc destock (t - 1)
[S23]	TRANSF HARDW (t) = TRANSF HARDW (t - 1) + Hardw (t - 1) - Ic hardw (t - 1)
[S24]	TRANSF SOFTW (t) = TRANSF SOFTW (t - 1) + Softw (t - 1) - Ic softw (t - 1)
[S25]	ASSIM HARDW (t) = ASSIM HARDW (t - 1) + Ic Hardw (t - 1) + Imp hardw (t - 1)
[S26]	ASSIM SOFTW (t) = ASSIM SOFTW (t - 1) + Ic softw (t - 1) - Imp softw (t - 1)
FLOWS (t)	
[F1]	Pc wind (t) = MIN [(((pc tot (t) / wind price (t)) × pc ratio wind) - Pc wind (t - 1)), WIND SALE (t)]
[F2]	Pc timb (t) = MIN [(((pc tot (t) / timb price) × (1 - pc ratio wind)) - Pc timb (t - 1)), TIMB SALE (t)]
[F3]	In timb (t) = offer (t) × vol timb norm (t) × timb rep (t)
[F4]	Hc wind (t) = MIN [(hc tot (t) × diff harv × hc ratio wind), WIND HARV (t)]
[F5]	Hc prior (t) = MIN [hc tot timb (t), PRIOR TIMB (t)]
[F6]	Hc timb (t) = MIN [(hc tot timb (t) - Hc prior (t)), TIMB HARV (t)]
[F7]	Tc timb (t) = MIN [(nb trucks × mma × tr factor × (1 - tc ratio wind) × (1/mean dist) × (1 - tc inaccess)), TIMB TRANSP (t)]
[F8]	Tc wind (t) = MIN [(trucks wind × trucks rep × mma × tr factor × (1/mean dist) × (1 - tc inaccess)), (WIND TRANSP (t) - tc stock (t))]
[F9]	Tc stock (t) = MIN [(trucks wind × trucks rep × mma × tr factor × (1/dist store) × (1 - tc inaccess)), WIND TRANSP (t), (stock - STORAGE (t - 1))]
[F10]	Tc destock (t) = MIN [(trucks wind × trucks rep × mma × tr factor × (1/dist store) × (1 - tc inaccess)), STORAGE (t)]
[F11]	Exp hardw (t) = MIN [ex hardw (t), ((ROUNDWOOD (t) - Exp softw (t) - Softw (t)) - Hardw (t))]
[F12]	Exp softw (t) = MIN [ex softw (t), ((ROUNDWOOD (t) - Exp hardw (t) - Hardw (t)) - Softw (t))]
[F13]	Hardw (t) = MIN [Ic hardw (t), (ROUNDWOOD (t) - Softw (t) - Exp hardw (t) - Exp softw (t))]
[F14]	Softw (t) = MIN [Ic softw (t), (ROUNDWOOD (t) - Hardw (t) - Exp hardw (t) - Exp softw (t))]
[F15]	Ic hardw (t) = MIN [(pulp cap + saw cap + panel cap + fuel cap) × (1 - diff imp) × red prod, TRANSF HARDW (t)]
[F16]	Ic softw (t) = MIN [(pulp cap + saw cap + panel cap + fuel cap) × (1 - diff imp) × red prod, TRANSF SOFTW (t)]
[F17]	Imp hardw (t) = im hardw (t) × diff imp (t)
[F18]	Imp softw (t) = im softw (t) × diff imp (t)

Table S2. *Cont.*

CONVERTERS (t)	
[C1]	$\text{wind price (t)} = \text{price init} \times (\text{wind dev (t)} + \text{wind dev supp (t)})$
[C2]	$\text{timb price} = \text{price init} \times \text{timb dev}$
[C3]	$\text{timb to pay} = (\text{vol timb init} \times \text{price init}) \times (1 - \text{pay delay})$
[C4]	$\text{pc tot (t)} = (\text{vol timb norm} \times \text{timb price} \times (1 + \text{diff imp}) \times (1 + \text{demand})) - \text{timb to pay}$
[C5]	$\text{hc tot (t)} = ((\text{man prod} \times \text{workforce}) + (\text{mec prod} \times \text{harvesters})) \times \text{harv syst} \times (1 - \text{hc inaccess})$
[C6]	$\text{hc tot timb (t)} = \text{hc tot (t)} \times (1 - \text{hc ratio wind})$
[C7]	$\text{tr factor} = (\text{h work} / (((\text{mean dist} / \text{mean speed}) \times 2) + \text{load unload})) \times ((\text{mma} - \text{tare weight}) / \text{mean density})$
[C8]	$\text{trucks wind} = \text{nb trucks} \times \text{tc ratio wind}$

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