A model using marginal efficiency of investment to analyse carbon and nitrogen interactions in terrestrial ecosystems (ACONITE Version 1)

R. Q. Thomas[1*] and M. Williams[2*]

[1] {Department of Forest Resources and Environmental Conservation, Virginia Tech, Blacksburg, Virginia}

[2] {School of GeoSciences, University of Edinburgh, Edinburgh, Scotland and NERC National Centre for Earth Observation, EH9 3JN, United Kingdom}

Correspondence to: R. Q. Thomas (rqthomas@vt.edu) or M. Williams (mat.williams@ed.ac.uk)

Supplemental material

Table S1 Rules for adjusting the maximum leaf N, based on three tests.

Leaf N return > 0	Reach Max leaf N in last year	Leaf N deficient in previous year	Outcome
Yes	Yes	No	Increase leaf N
Yes	No	No	Decrease leaf N
Yes	No	Yes	Decrease leaf N
Yes	Yes	Yes	Hold leaf N
No	n/a	n/a	Decrease leaf N

Table S2. Rules for adjusting the maximum leaf C, based on four tests.

Reach max. leaf C in last year	Leaf C return > 0	Reached wood and root requirement in last year	Leaf N deficient in previous year	Outcome
Yes	Yes	Yes	n/a	Increase leaf C
Yes	Yes	No	n/a	Decrease leaf C
Yes	No	n/a	n/a	Decrease leaf C

No	n/a	n/a	No	Decrease leaf C
No	n/a	n/a	Yes	Hold leaf C

Table S3. Rules for adjusting the maximum root C, based on five tests.

Reach Max Root C in last year	RootCreturn > N fix per C	RootCNreturn >0	Max Root C < Max leaf C * min root to leaf ratio	Leaf N deficient in previous year	Outcome
Yes	Yes	Yes	n/a	Yes	Increase max root C
Yes	Yes	Yes	n/a	No	Hold root C
Yes	No	n/a	No	n/a	Decrease root C
Yes	n/a	No	No	n/a	Decrease root C
No	n/a	n/a	No	n/a	Decrease root C
n/a	n/a	n/a	Yes	n/a	Increase root C

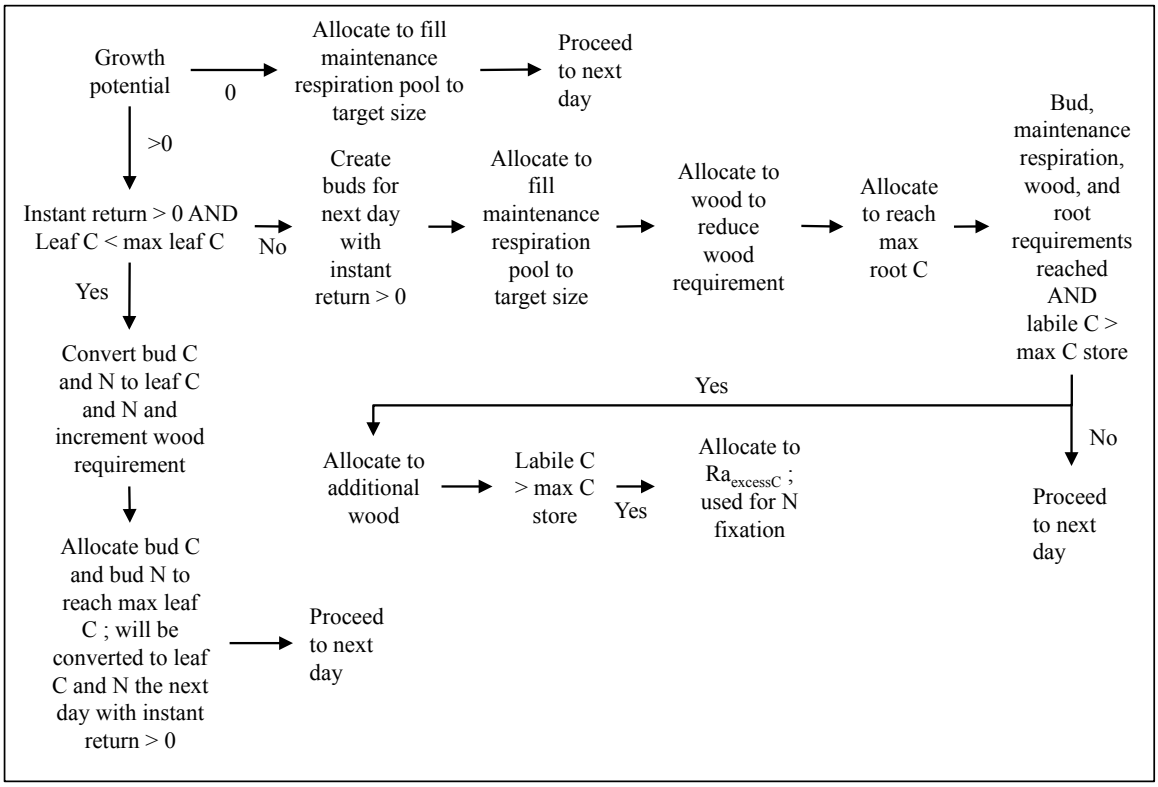

Figure S1. Plant allocation strategy used in ACONITE. The schematic shows how, beginning from the assessment of whether active growth is occurring (top left), the model makes choices for allocation based on a decision tree.

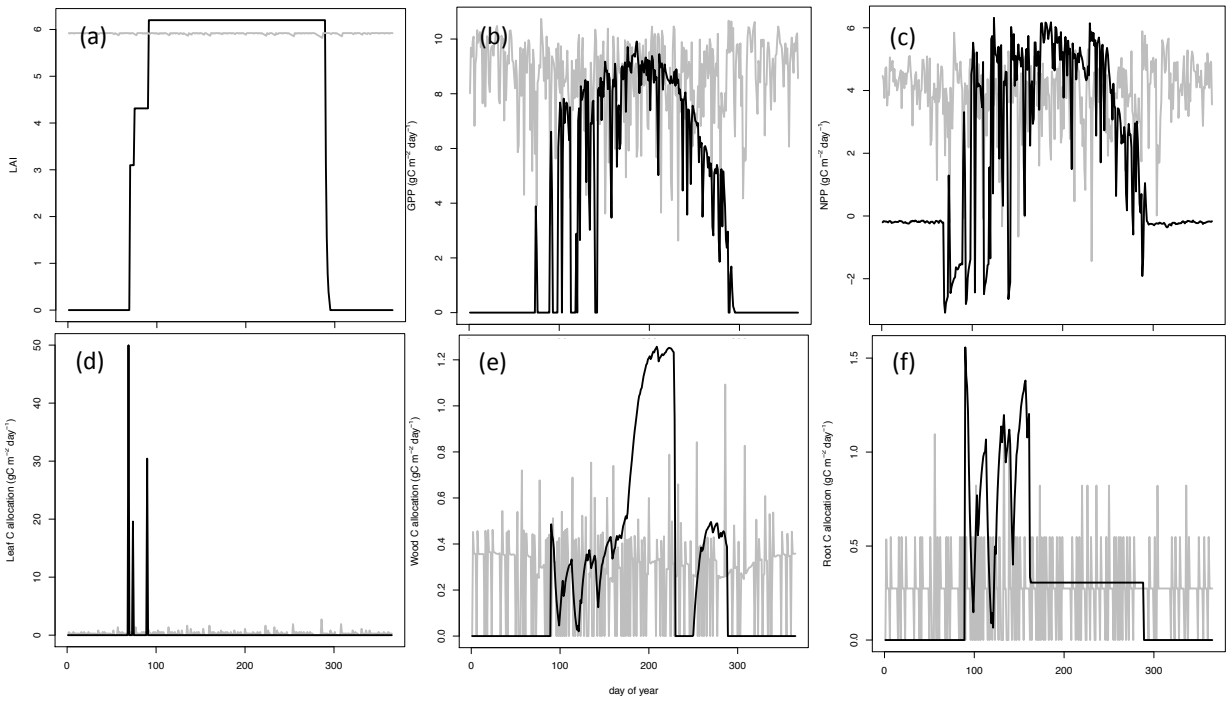

Figure S2. Seasonal dynamics of key pools and fluxes for temperate deciduous (black) and tropical (grey) ecosystems at annual steady state. Daily values for (a) leaf area index (LAI), (b) gross primary production (GPP), net primary production (NPP), (d) allocation to leaves, (e) allocation to wood, and (f) allocation to roots are shown. LAI (a) and leaf C (b) allocation reflect growing degree-day and senescence date parameterizations in the temperate forest. Wood (e) and root allocations (f) reflect the allocation rules described in the main text. The wood allocation initially meets the requirement based on the parameterized leaf allocation to wood allocation ratio. A second growth of wood is associated with the allocation of excess carbon fixed during the year in the temperate seasonal forest. Root allocation (f) is associated with meeting and maintaining a maximum root C target.