

Supplementary Information SI.2

Modelling Results

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Description

This supporting information contains the substance flow system diagrams of all sub-systems for the baseline and TPAD scenario.

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SI 2-1. Substance flow diagrams – generic

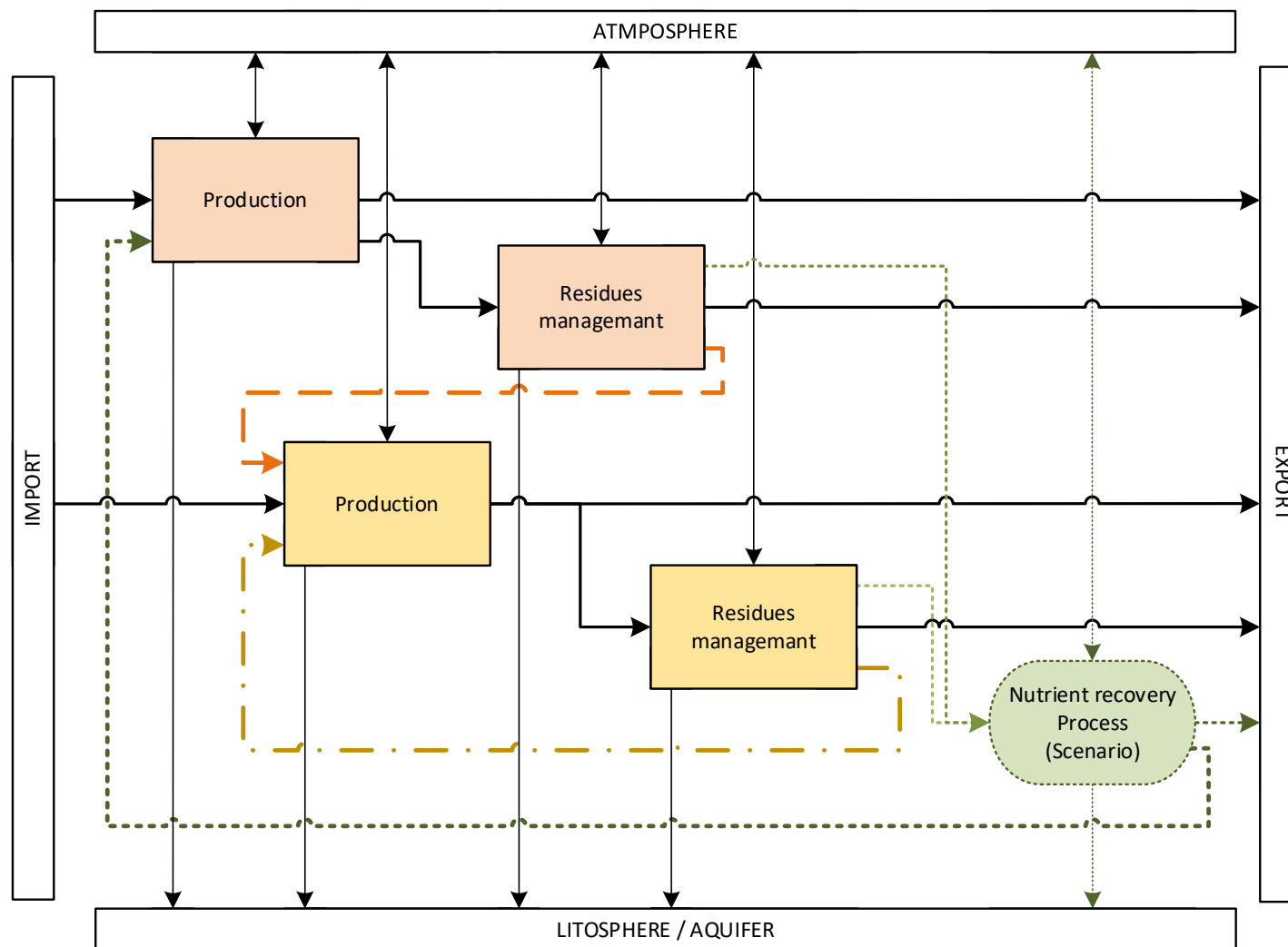


Figure 1 - extended generic monitoring framework - exemplary system with two sectors (orange and yellow) and intra-sectoral flow (dash-dotted, dark yellow) and inter-sectoral recirculation flow (dashed, orange), optional nutrient recovery process is indicated in green, diffuse emission flows to atmosphere and lithosphere / aquifer are indicated.

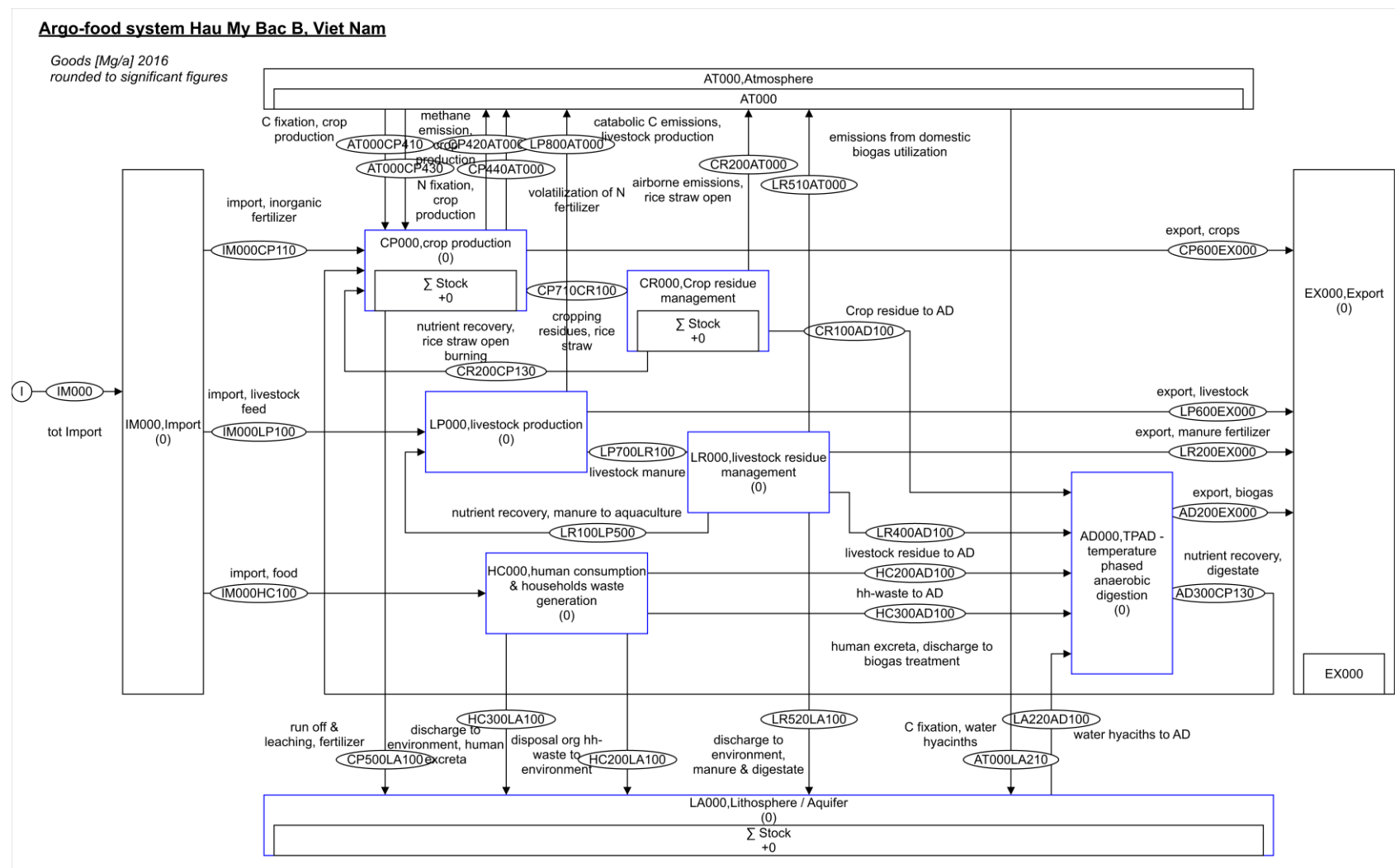


Figure 2 - Main-system, all flows and flow names, model of the agro-food-waste-system in Hậu Mỹ Bắc B in 2016, with TPAD

Sub-processes are shown framed in blue. The processes and sub-processes are named systematically with a five-digit code. The two letters, represent the system, followed by 3 digits representing processes and level of sub-process – e.g., ‘CP214 – fertilizer loss distribution, rice’ is the fourth process in the sub-process ‘rice cultivation (CP210)’ in the sub-system ‘Crop production, rice (CP200)’. Flows are consequently names with a 10-digits classification, the first five characters represent the process of origin followed by process of destination - e.g. CP214CP500 is the ‘fertilizer run off fertilizer, rice cultivation’ from process named above to the aggregation process ‘CP500 emissions to lithosphere and aquifer, crop production’.

SI 2-2. Substance flow diagrams – baseline scenario

SI 2-2.1. Main-system

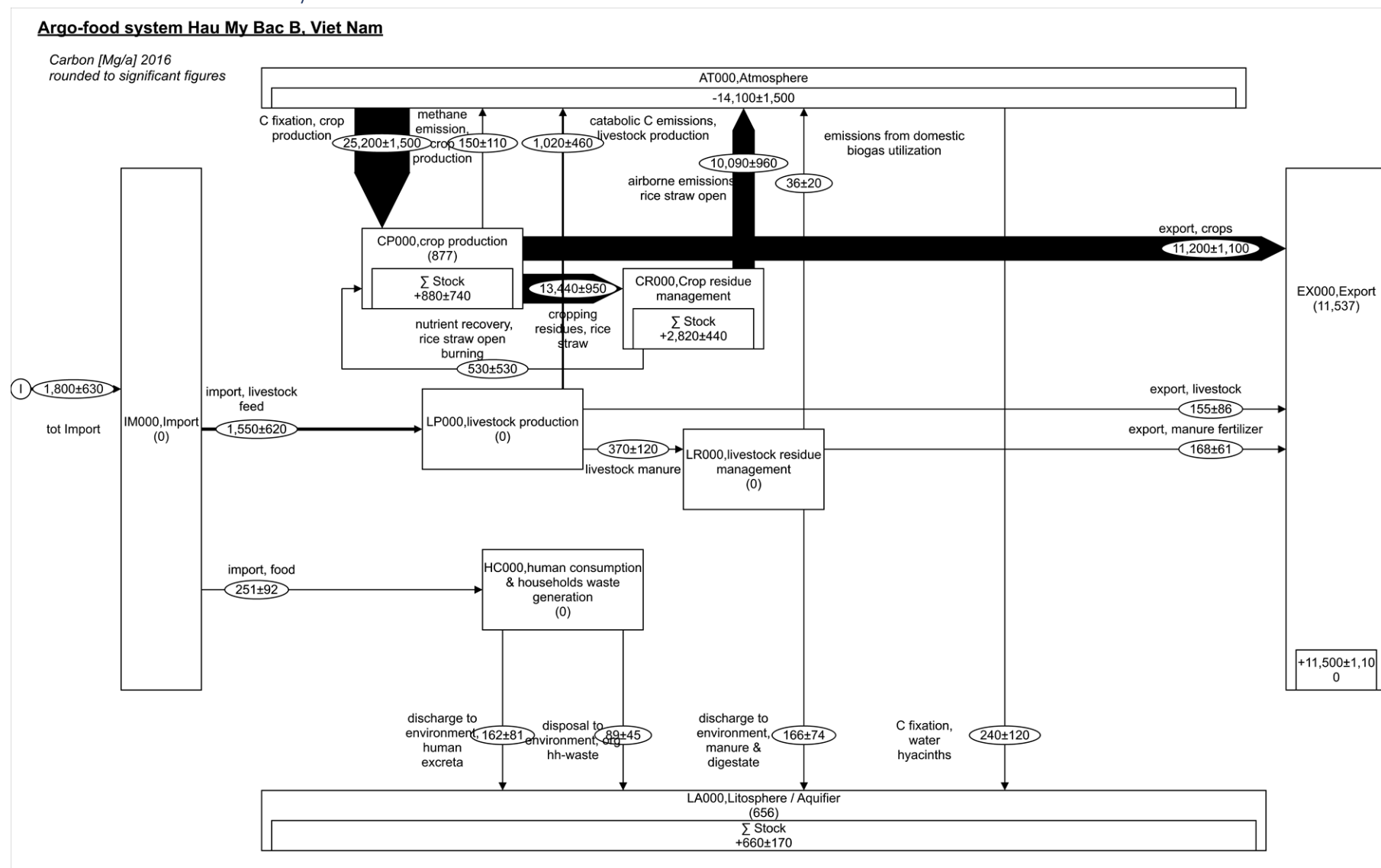


Figure 3 - Main System, Carbon flows [Mg/a], of the agro-food-waste-system in Hàu Mỹ Bắc B in 2016, without TPAD

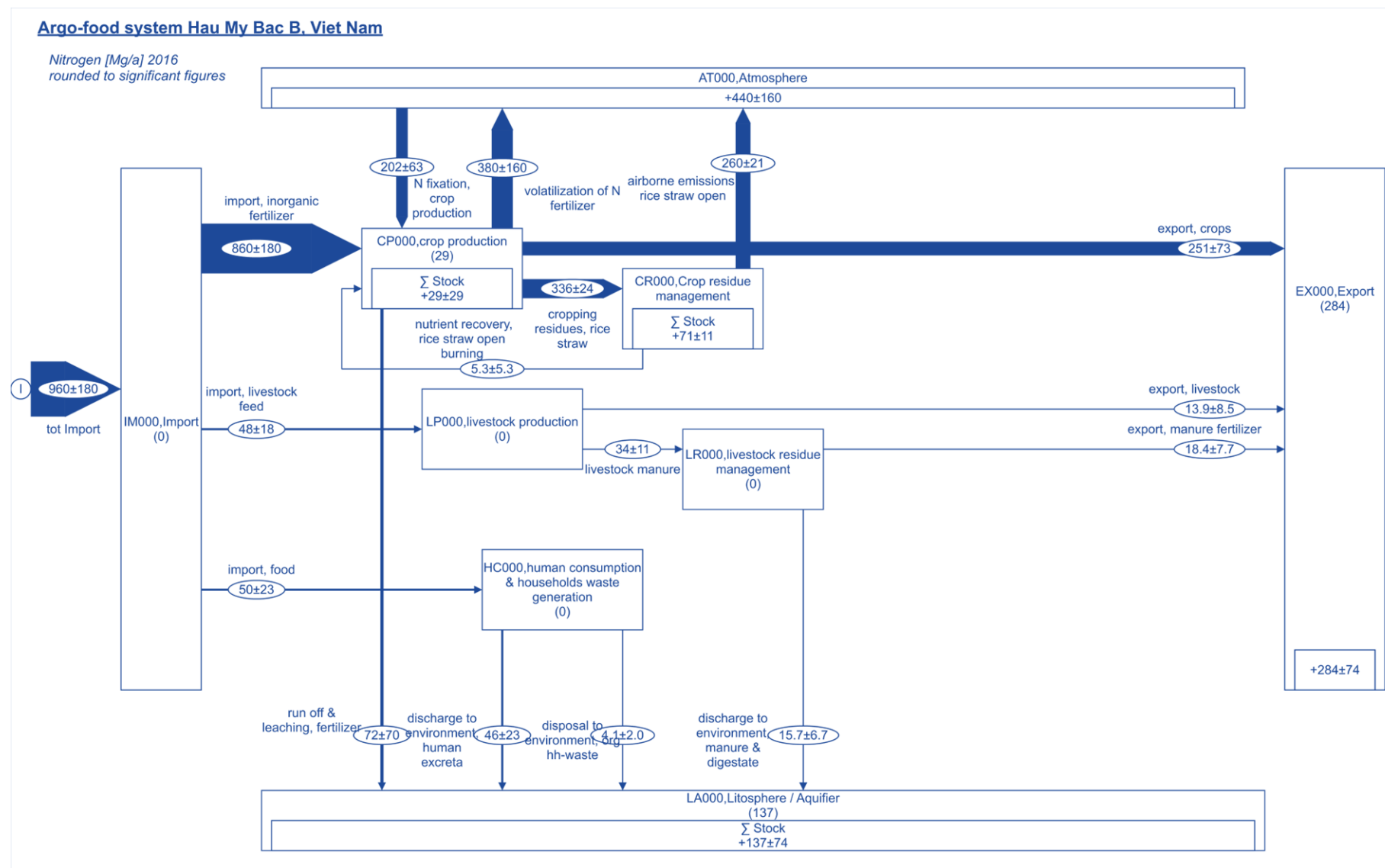


Figure 4 - Main System, Nitrogen flows [Mg/a], of the agro-food-waste-system in Hàu Mỹ Bắc B in 2016, without TPAD

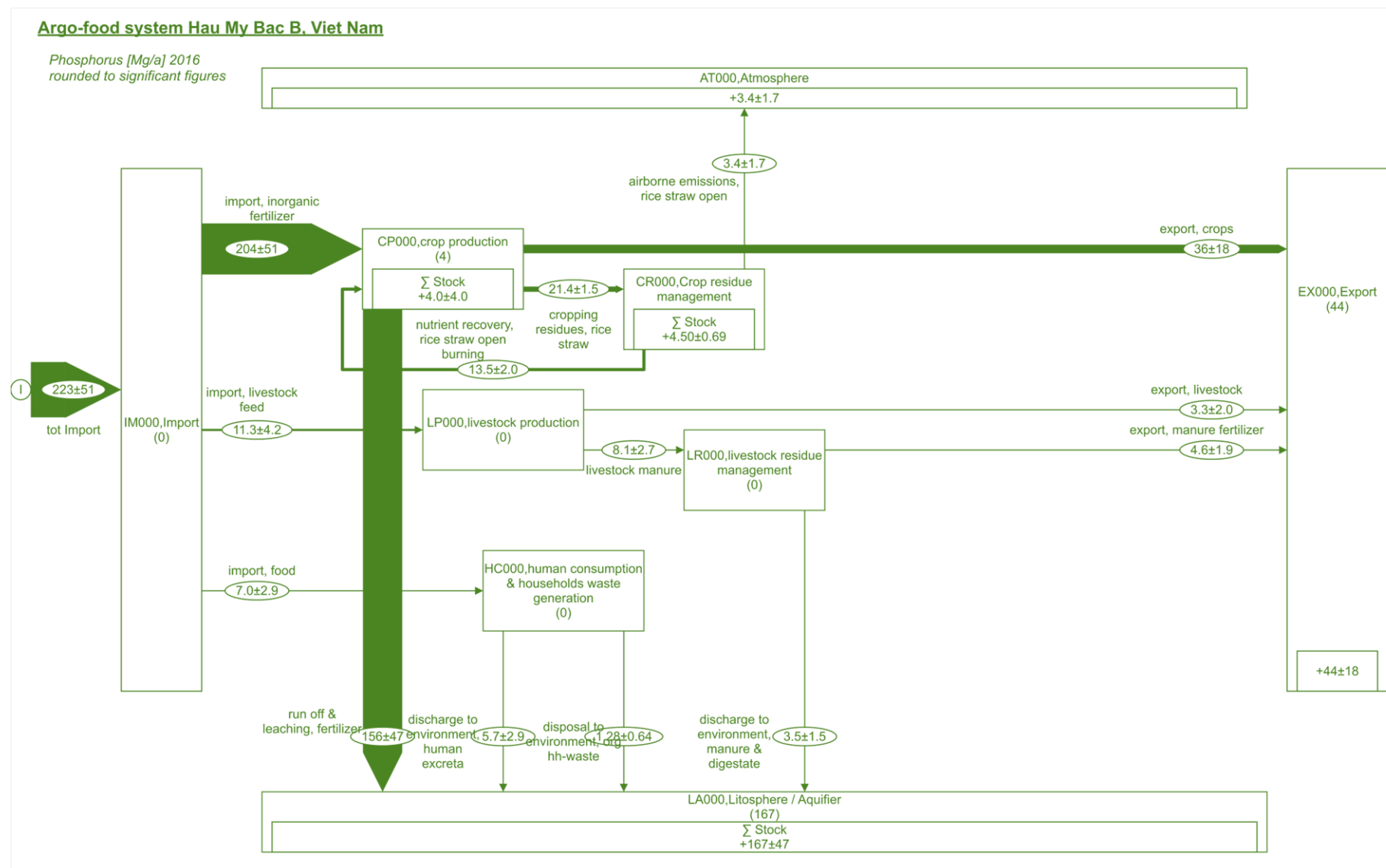
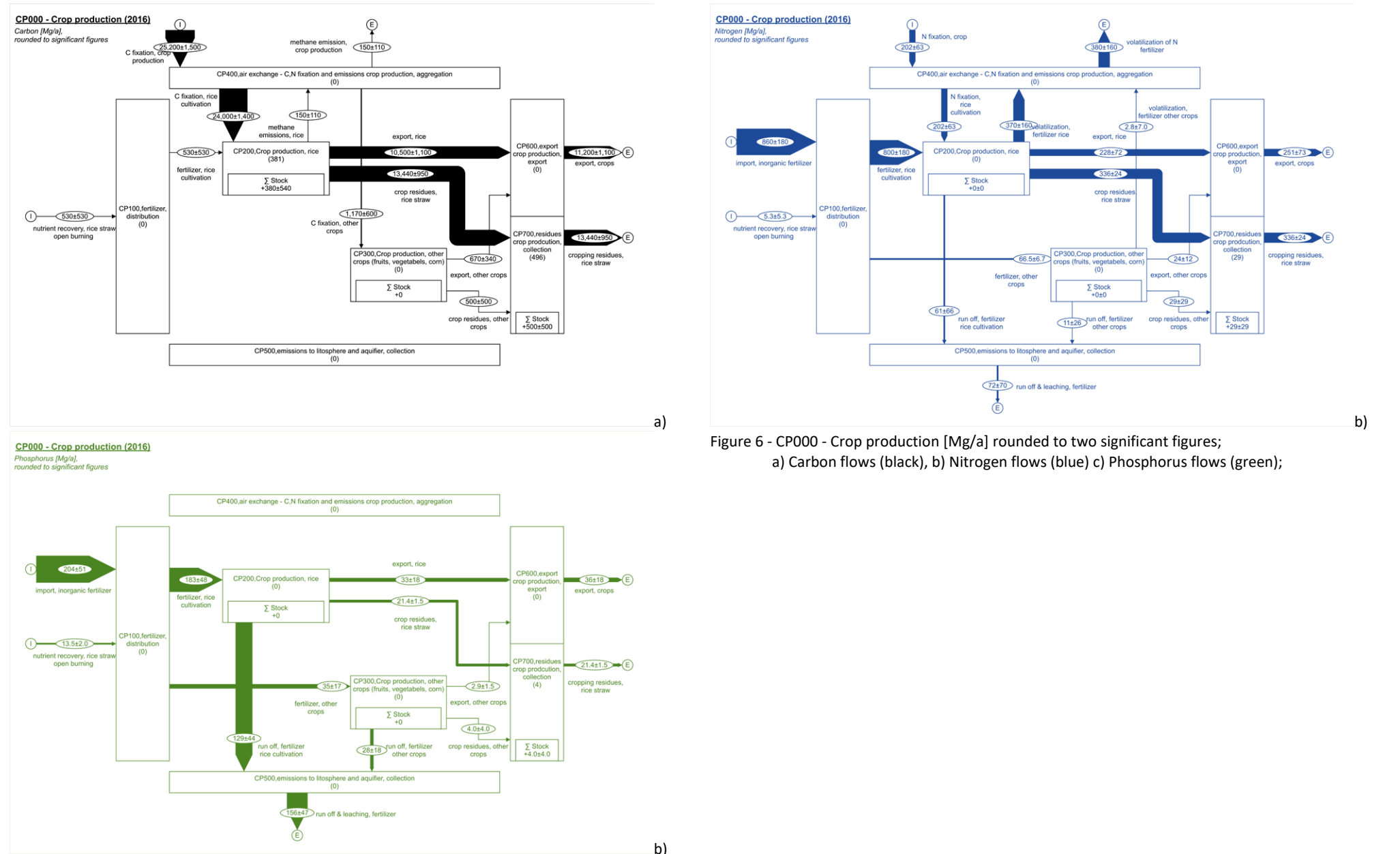
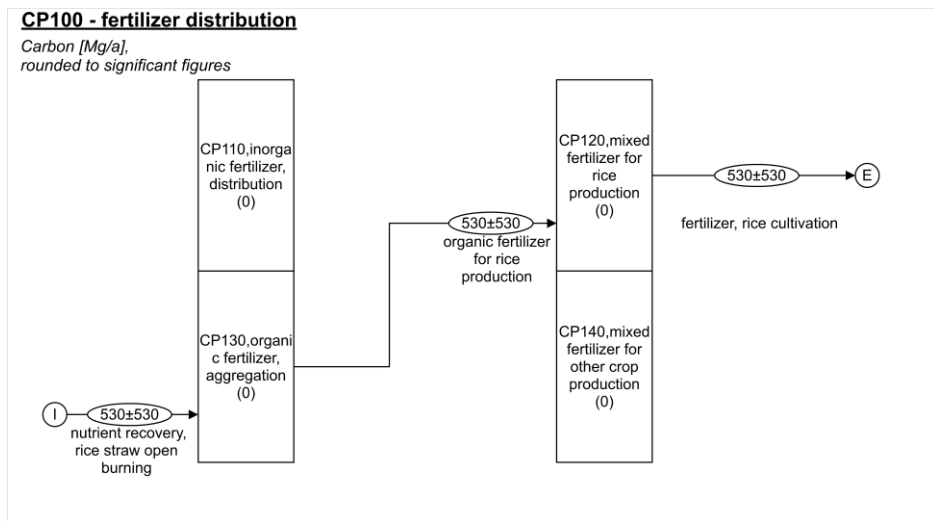


Figure 5- Main System, Phosphorus flows [Mg/a], of the agro-food-waste-system in Hậu Mỹ Bắc B in 2016, without TPAD

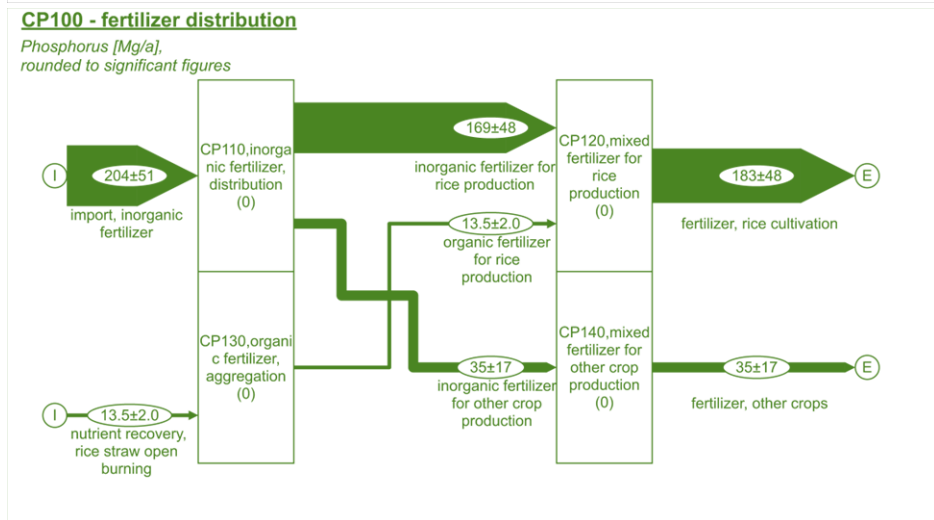
SI 2-2.2. CP000 – Crop production



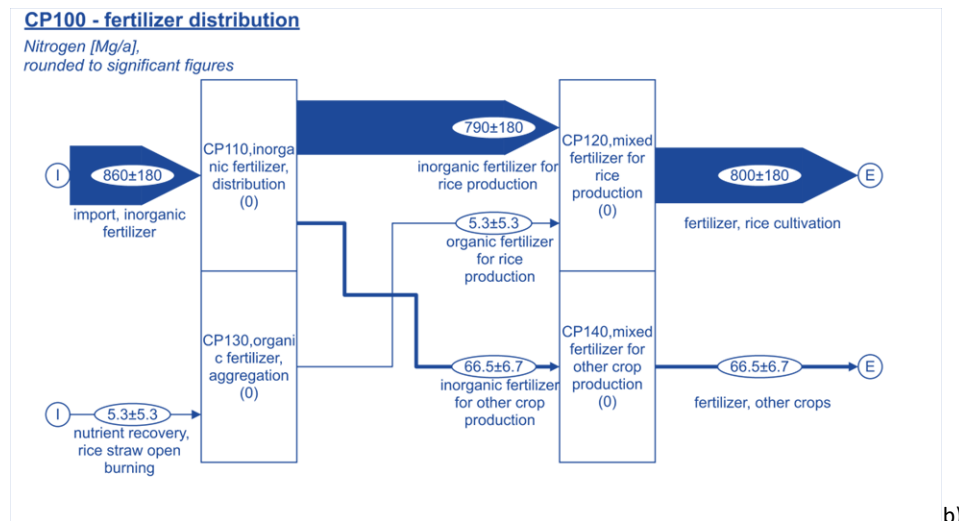
SI 2-2.2.1. CP100 – Fertilizer distribution



a)



c)



b)

Figure 7 - CP100 – fertilizer distribution, other crops [Mg/a] rounded to two significant figures;

a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

- a) organic Carbon is supplied by digestate and carbon residues from rice straw open burning
- b) Nitrogen fertilizer is supplied by organic and inorganic fertilizer, only rice crop are supplied by organic fertilizer
- c) Phosphorus fertilizer is supplied by organic and inorganic fertilizer, only rice crop are supplied by organic fertilizer

SI 2-2.2.2. CP200 – Crop production, rice

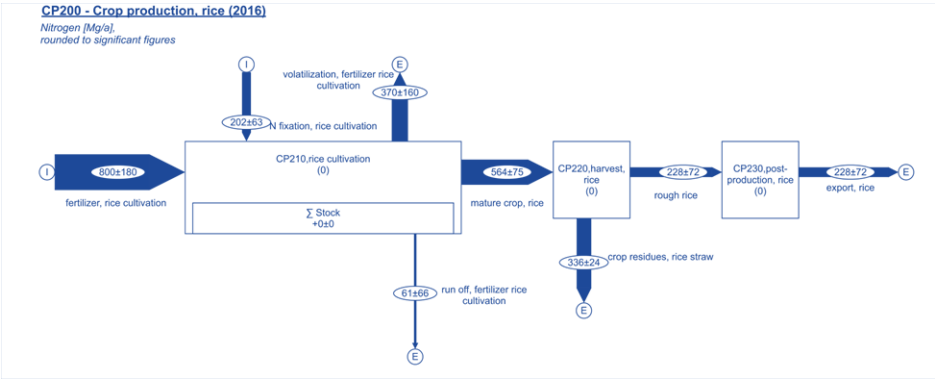
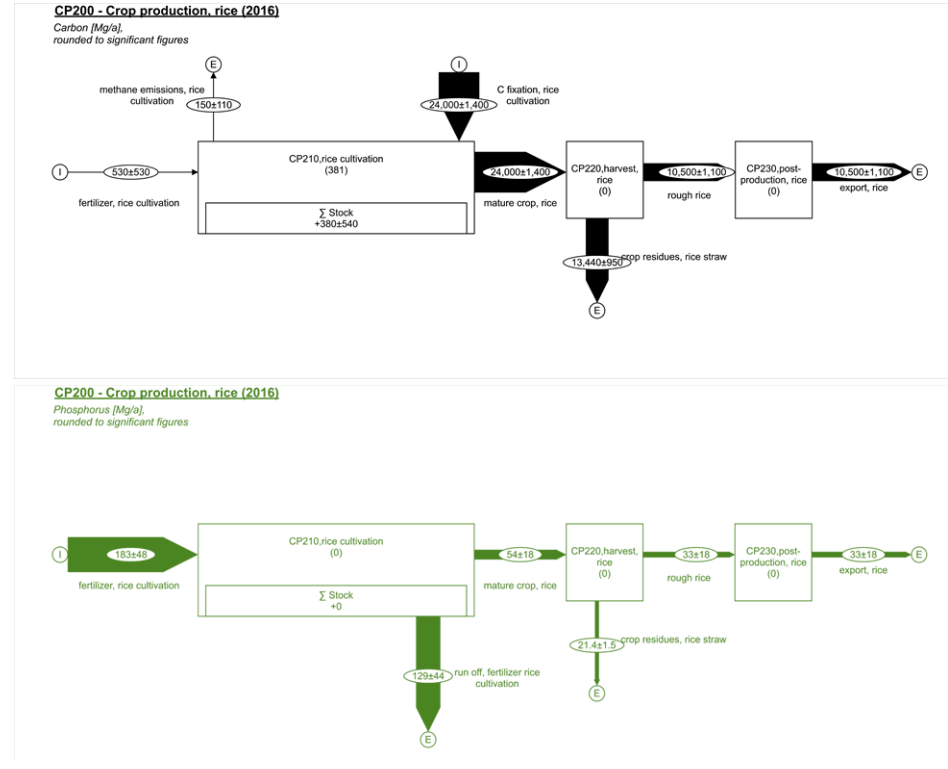


Figure 8 - CP 200 - Crop production, rice [Mg/a] rounded to two significant figures;
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

- a) organic Carbon is supplied by biogas digestate, methane emissions from soil organic carbon are emitted, residual organic carbon is going to soil stock; plant only assimilate from inorganic carbon
- b) nitrogen fertilizer (organic and inorganic) is supplied to the field, no soil nitrogen stock is considered; N fixation in rice fields; nutrient use efficiency for nitrogen fertilizer is assumed to be the same for organic and inorganic fertilizers; volatilization of N fertilizer is larger than run off
- c) phosphorus fertilizer (organic and inorganic) is supplied to the field, no soil phosphorus stock is considered; low phosphorus nutrient use efficiency, subject to run off;

SI 2-2.2.2.1. CP 210 – Crop production, rice cultivation

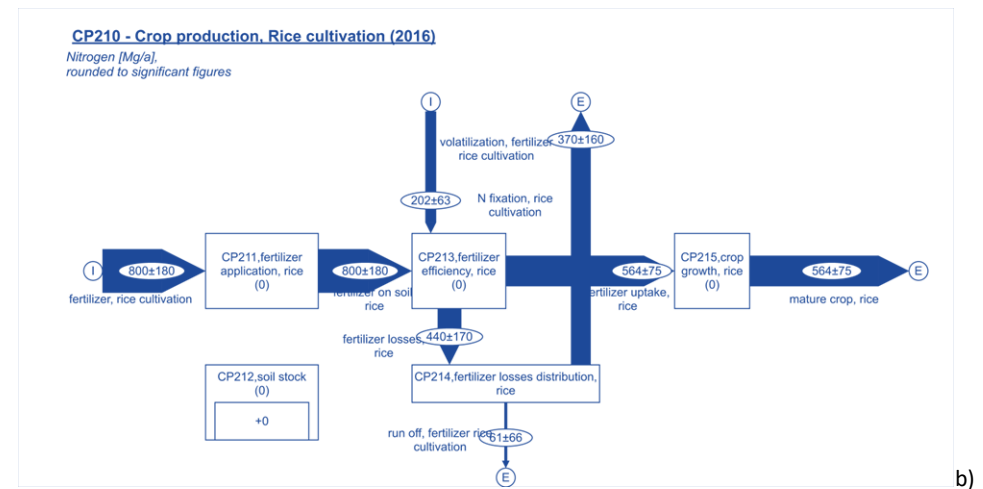
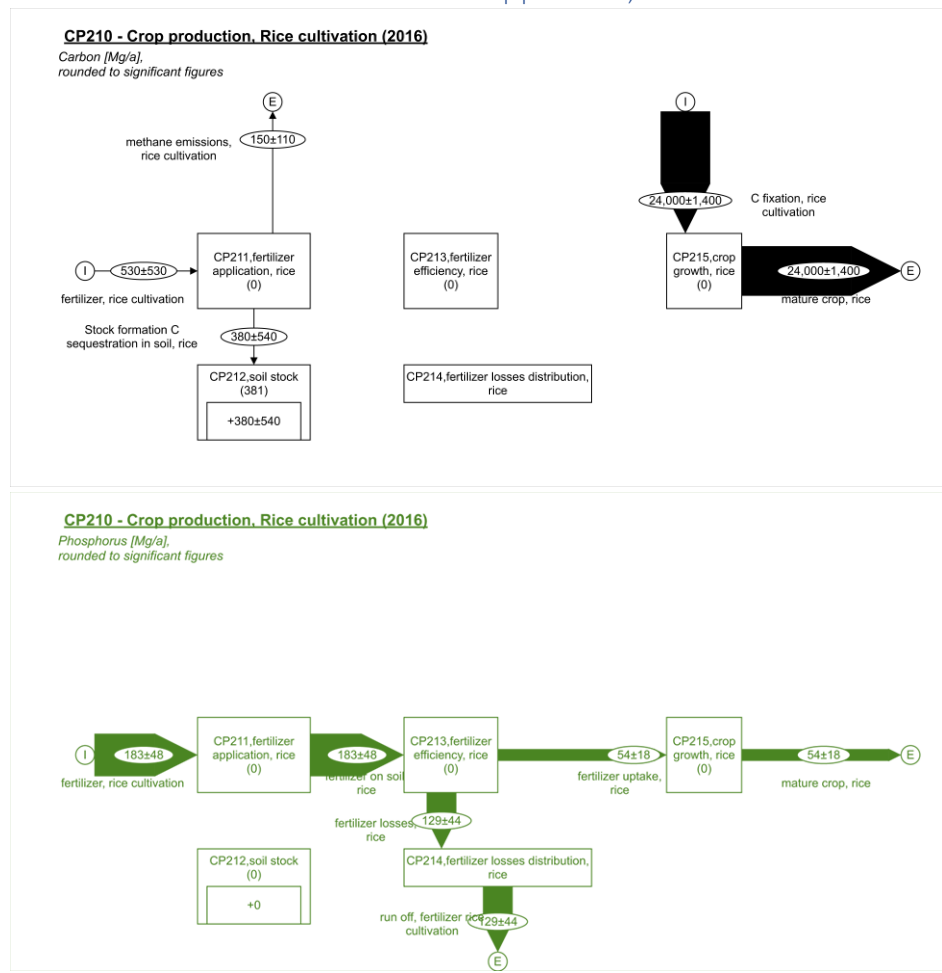


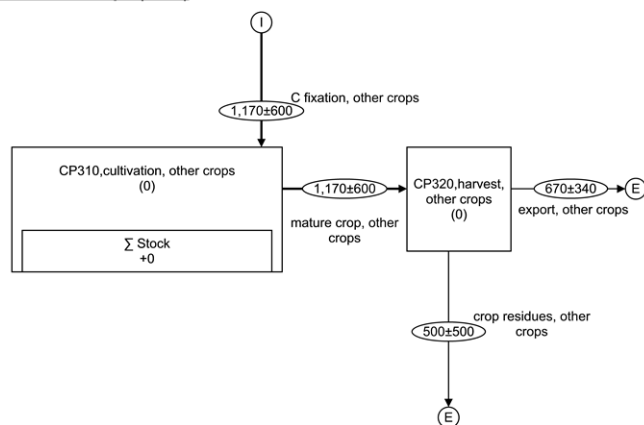
Figure 9 - CP 210 - Crop production, rice cultivation [Mg/a] rounded to two significant figures;
 a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

- a) organic Carbon is supplied by biogas digestate, methane emissions from soil organic carbon are emitted, residual organic carbon is going to soil stock; plant only assimilate from inorganic carbon
- b) nitrogen fertilizer (organic and inorganic) is supplied to the field, no soil nitrogen stock is considered; N fixation in rice fields; nutrient use efficiency for nitrogen fertilizer is assumed to be the same for organic and inorganic fertilizers; volatilization of N fertilizer is larger than run off
- c) phosphorus fertilizer (organic and inorganic) is supplied to the field, no soil phosphorus stock is considered; low phosphorus nutrient use efficiency, subject to run off;

SI 2-2.2.3. CP300 – Crop production, other crops

CP300 - crop production, other crops (2016)

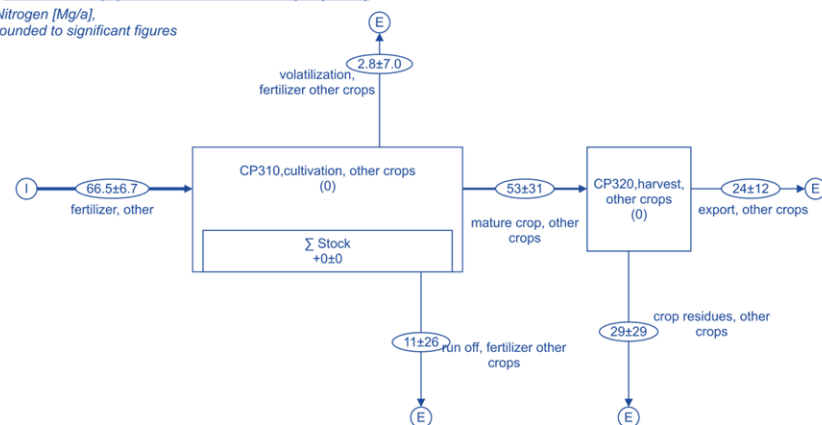
Carbon [Mg/a],
rounded to significant figures



a)

CP300 - crop production, other crops (2016)

Nitrogen [Mg/a],
rounded to significant figures



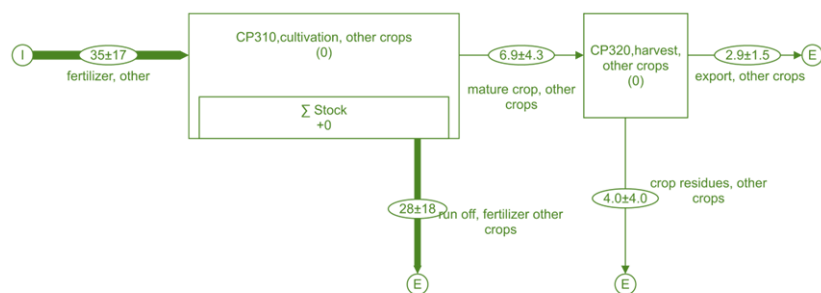
b)

Figure 10 - CP 300 - Crop production, other crops [Mg/a] rounded to two significant figures;

- a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);
- no organic carbon is supplied to other crops, assimilation of inorganic carbon, distribution of crop product and crop residue according to average residue-to-product rate (RPR)
 - inorganic nitrogen fertilizer is supplied to the field, nitrogen loss from fertilizer run off and volatilization, distribution of crop and crop residue according to average residue-to-product rate (RPR)
 - inorganic phosphorus fertilizer is supplied to the field; phosphorus fertilizer run off; distribution of crop and crop residue according to average residue-to-product rate (RPR)

CP300 - crop production, other crops (2016)

Phosphorus [Mg/a],
rounded to significant figures



c)

SI 2-2.2.3.1.

CP310 - Crop production, other crops cultivation

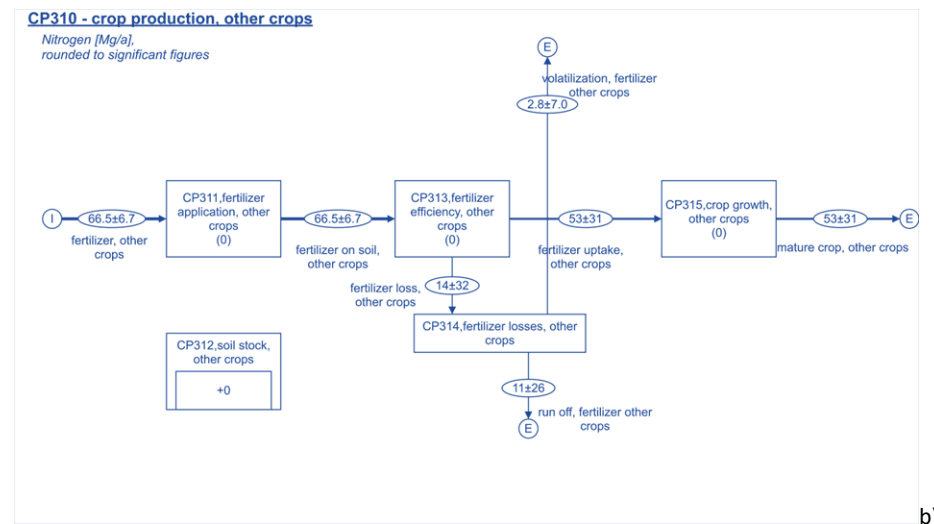
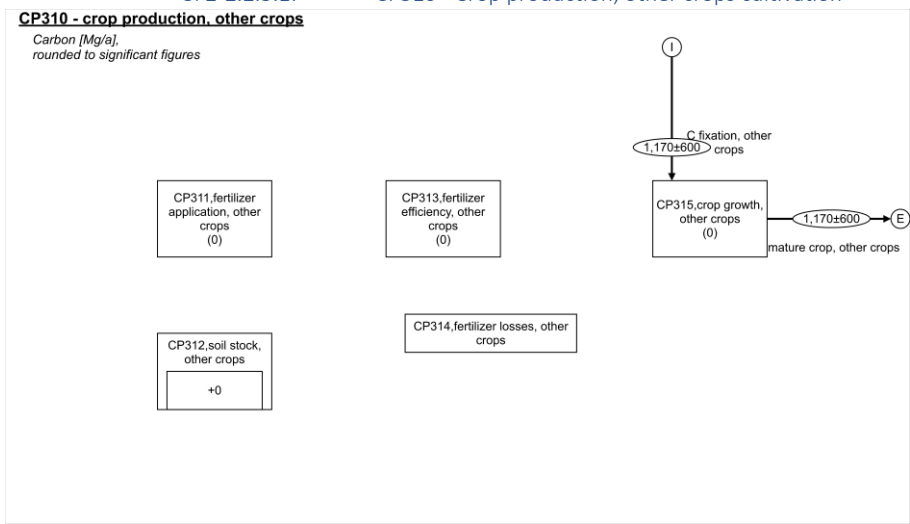
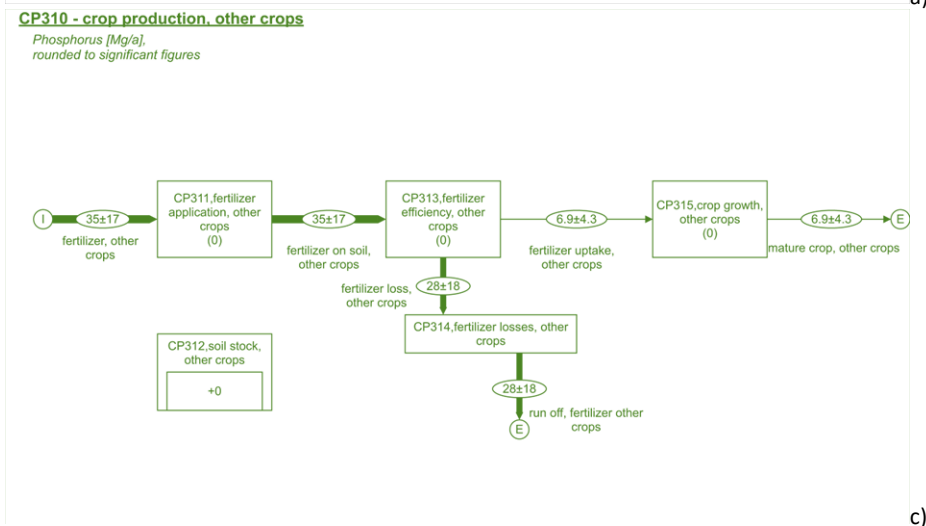


Figure 11 -- CP 310 - Crop production, other crops [Mg/a] rounded to two significant figures;
 a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);



- a) no organic carbon is supplied to other crops; no soil carbon stock; assimilation of inorganic carbon
- b) inorganic nitrogen fertilizer is supplied to the field, nitrogen loss from fertilizer run off and volatilization, fixation of atmospheric nitrogen is assumed to be not representative and not significant
- c) inorganic phosphorus fertilizer is supplied to the field; phosphorus fertilizer run off;

SI 2-2.2.4. CP400 - Air exchange, C, N fixation and emissions crop production, aggregation

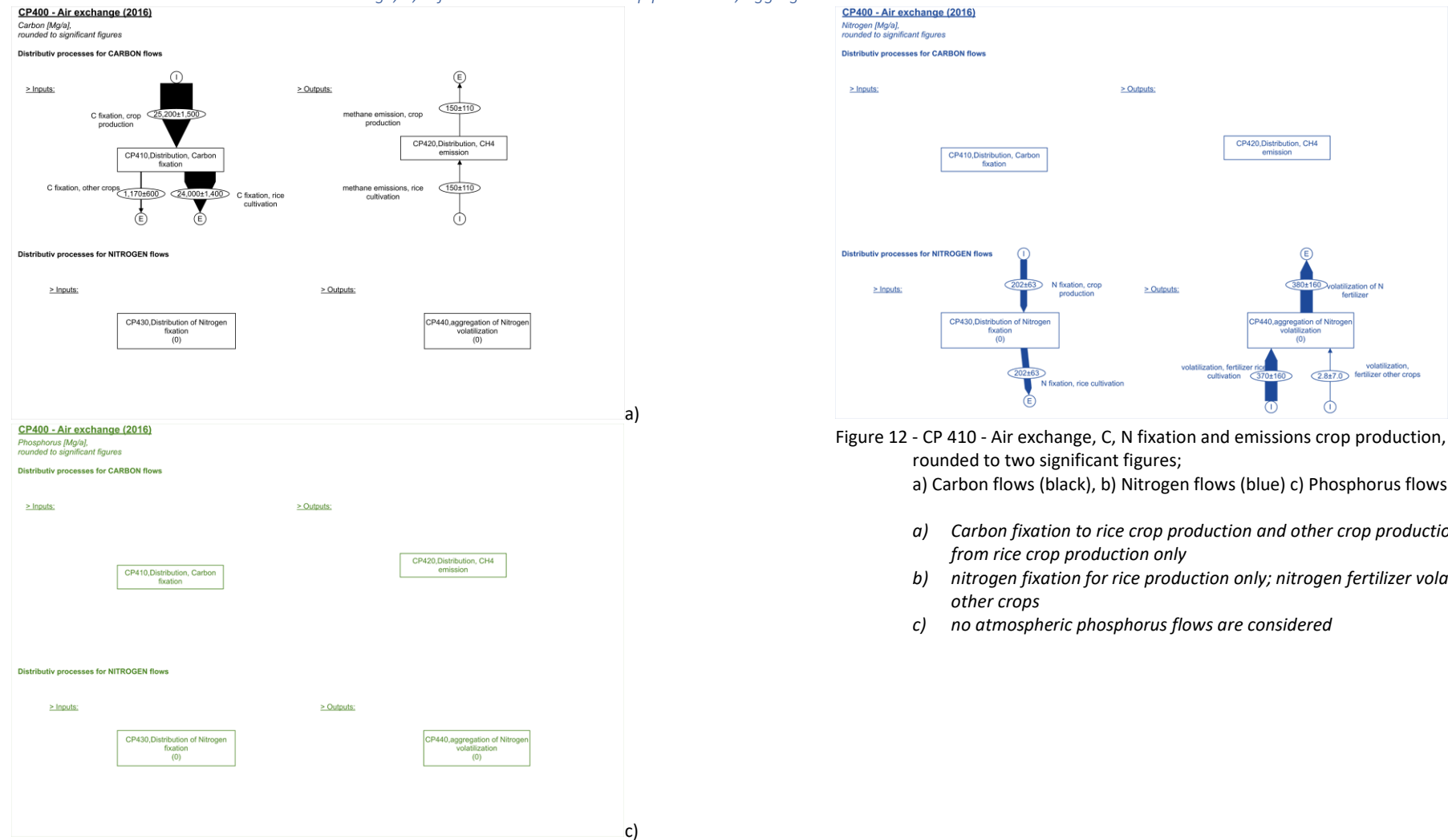


Figure 12 - CP 410 - Air exchange, C, N fixation and emissions crop production, aggregation [Mg/a] rounded to two significant figures;
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

- a) Carbon fixation to rice crop production and other crop production, Carbon emission from rice crop production only
- b) nitrogen fixation for rice production only; nitrogen fertilizer volatilization for rice and other crops
- c) no atmospheric phosphorus flows are considered

SI 2-2.2.5. CP700 - Residues crop production, collection

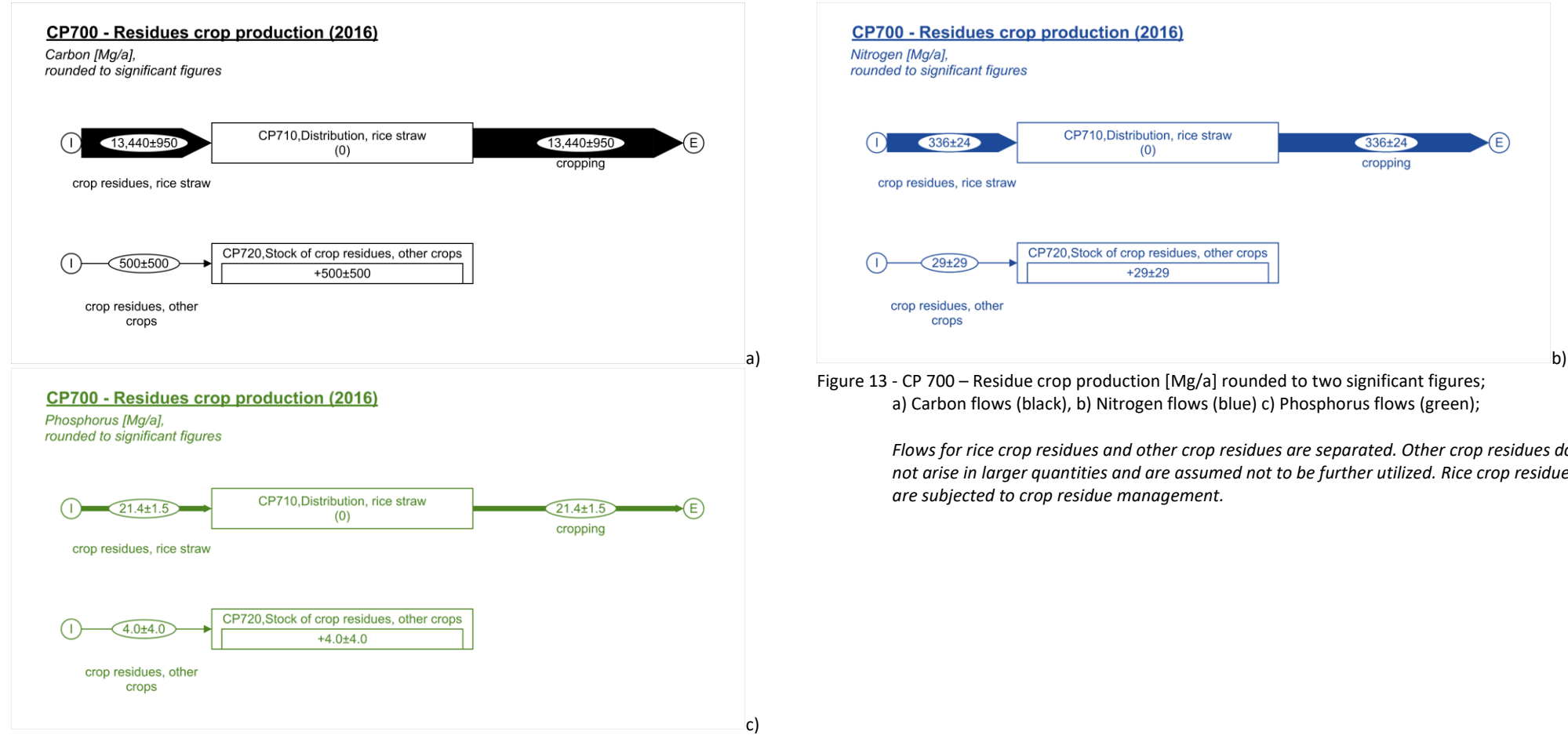


Figure 13 - CP 700 – Residue crop production [Mg/a] rounded to two significant figures;
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

Flows for rice crop residues and other crop residues are separated. Other crop residues do not arise in larger quantities and are assumed not to be further utilized. Rice crop residues are subjected to crop residue management.

SI 2-2.3. CR000 – Crop residue management

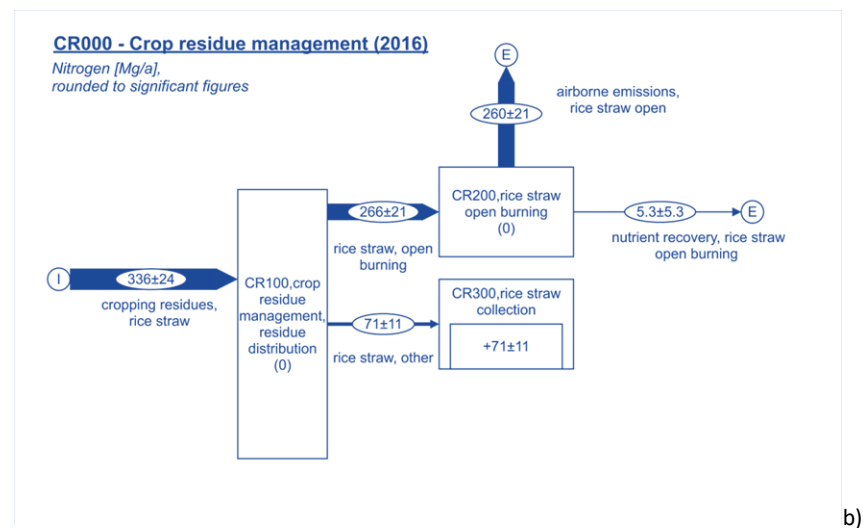
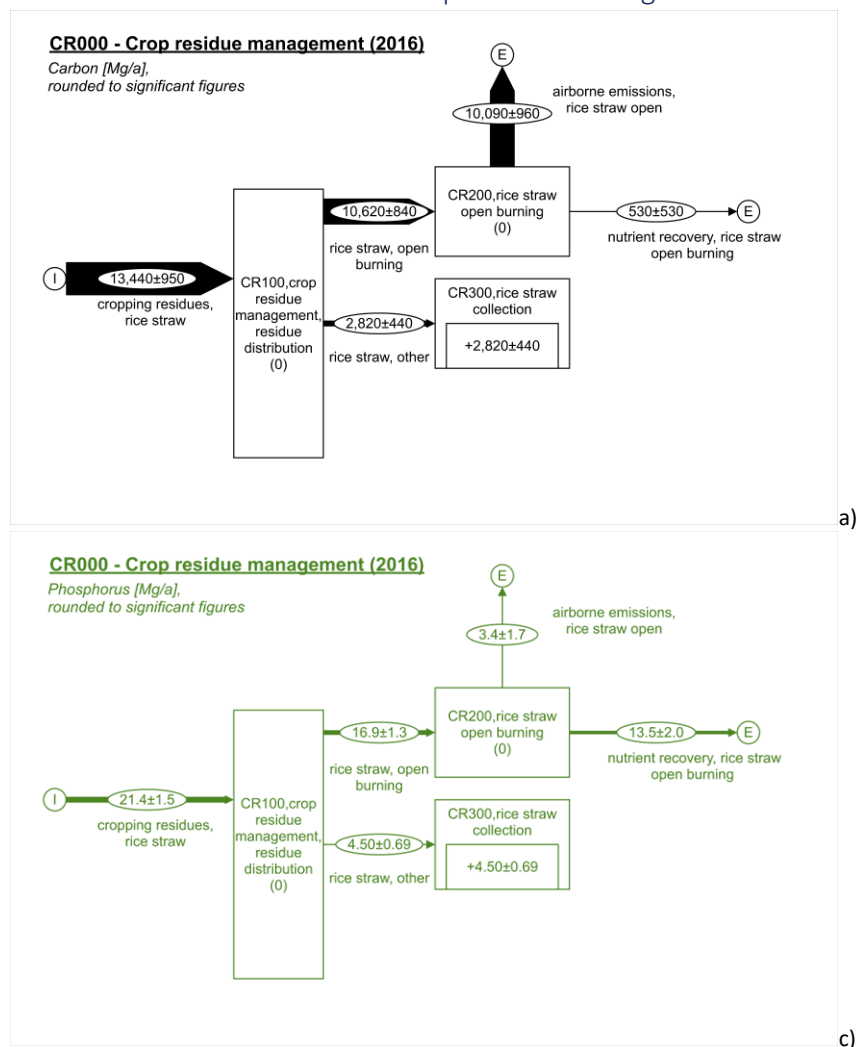


Figure 14 - CP000 - Crop residue management [Mg/a] rounded to two significant figures;

a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

Rice straw is subjected to rice straw open burning (CR200). Some Phosphorus, very little Nitrogen and little Carbon quantities are recovered to rice cultivation from the ash. and utilized (mushroom production, animal bedding,...) or stored in some cases (CR300). Rice straw that can be used with the co-substrates in the biogas process, does not need to be burned openly.

SI 2-2.4. LP000 – Livestock production

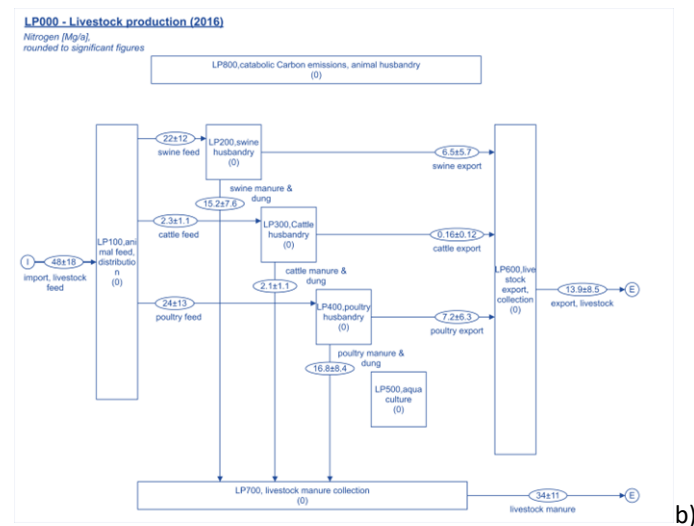
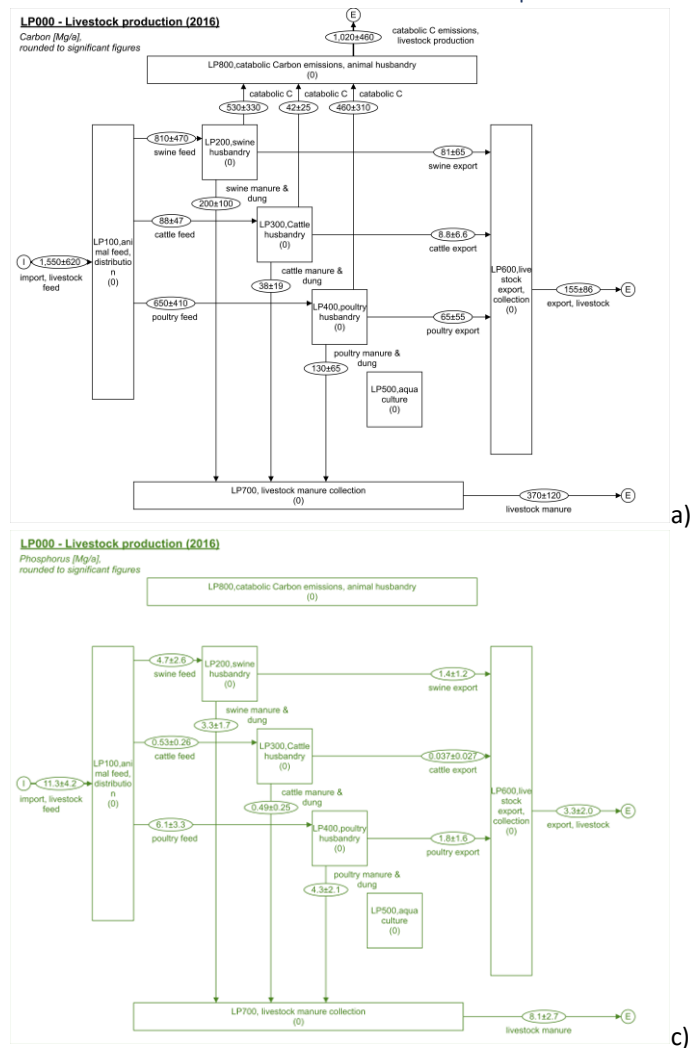


Figure 15 - LP000 - Livestock production [Mg/a] rounded to two significant figures;

a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

- Catabolic Carbon flow represent the metabolic losses or carbon from the livestock, assuming about 10 % of the Carbon intake get's assimilated. The residual carbon is excreted as manure & dung, or contained in the livestock products
- nitrogen from feed intake is distrusted to manure & dung as well as livestock products (further information ca be found in SI-1 modelling data)
- phosphorus from feed intake is distrusted to manure & dung as well as livestock products (further information ca be found in SI-1 modelling data)

LP500 aqua culture is not considered, due to little data

SI 2-2.5. LR000 – Livestock residue management

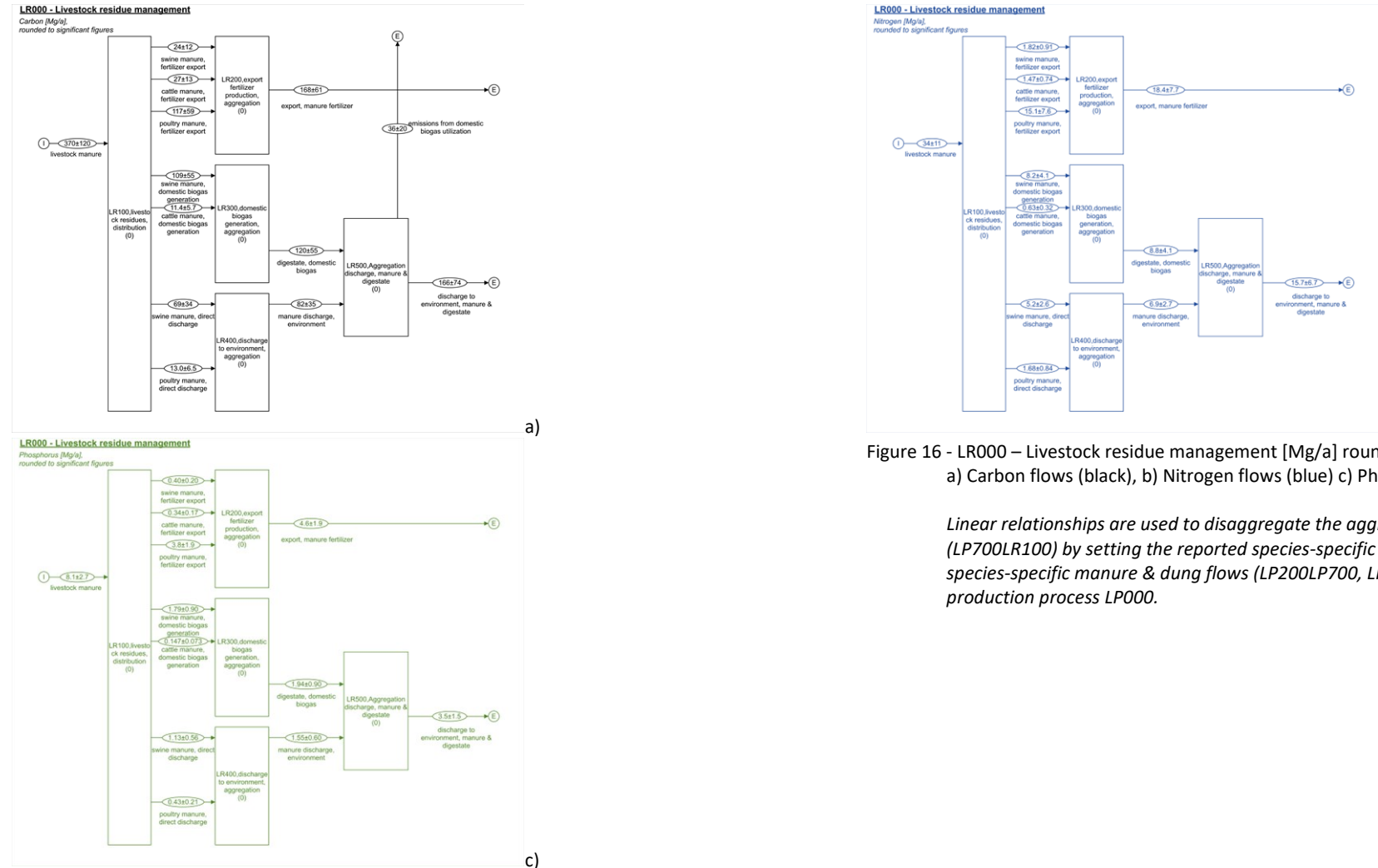
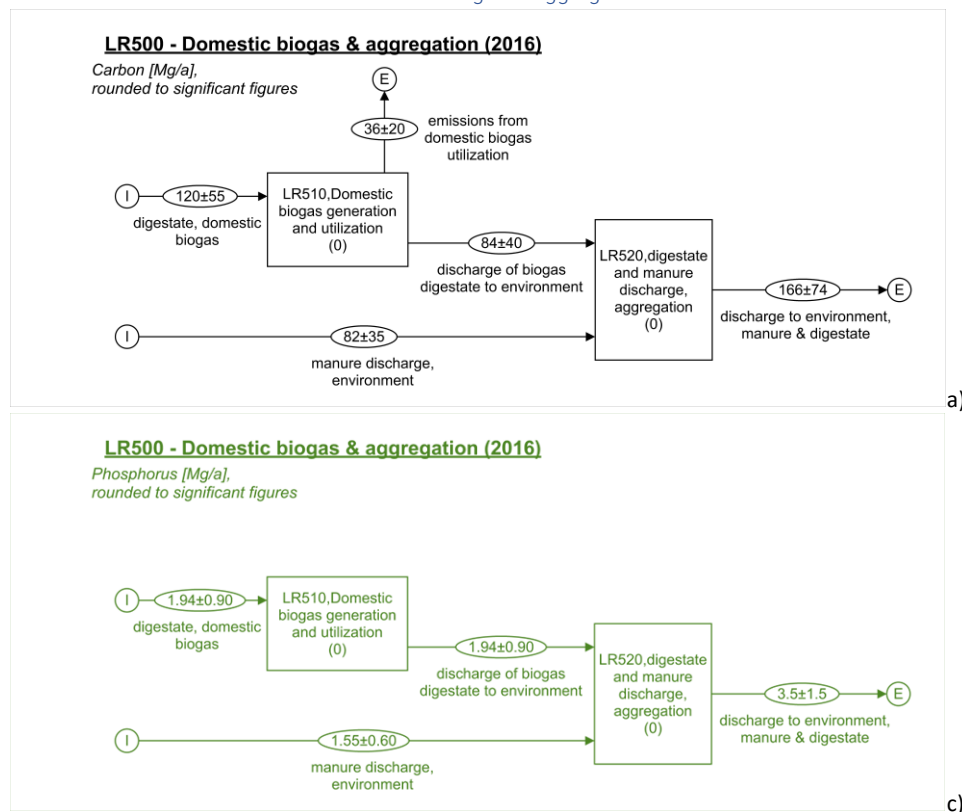


Figure 16 - LR000 – Livestock residue management [Mg/a] rounded to two significant figures;
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

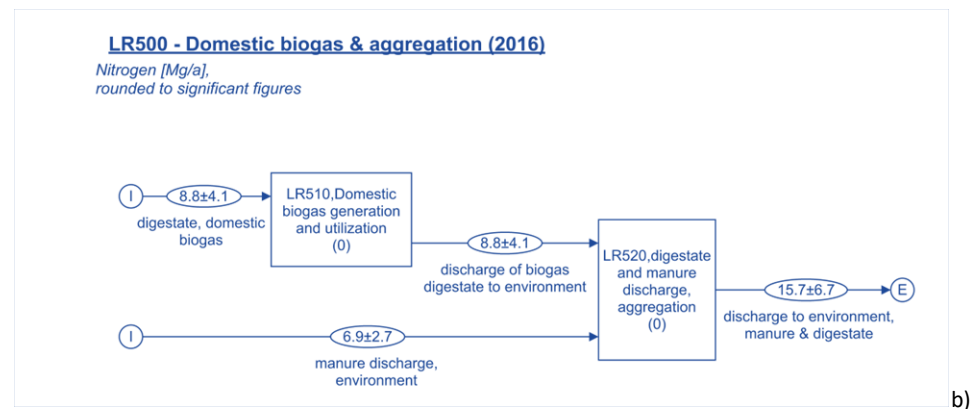
Linear relationships are used to disaggregate the aggregated manure & dung flow (LP700LR100) by setting the reported species-specific utilization ratios as factors for the species-specific manure & dung flows (LP200LP700, LP300LP700, LP400LP700) in livestock production process LP000.

SI 2-2.5.1. LR500 Domestic biogas & aggregation



a)

c)



b)

Figure 17 - LR5000 – Domestic biogas & aggregation [Mg/a] rounded to two significant figures;

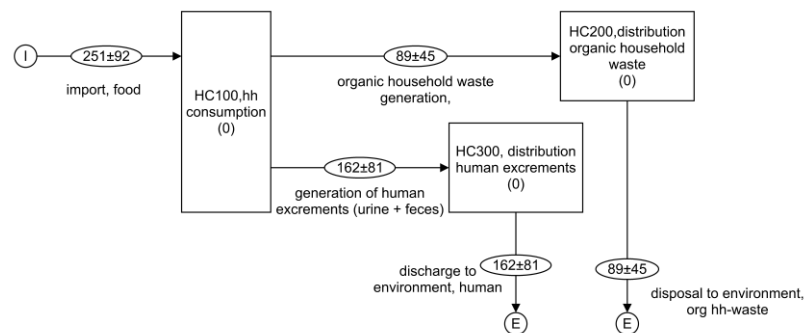
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

- a) biogas from domestic biogas plants is assumed to be utilized or released to the atmosphere (for this study it makes no difference for the environment as it does), residual carbon in the digestate is discharged to the environment, as is unused manure
- b) nitrogen in the digestate is discharged to the environment, as is unused manure
- c) phosphorus in the digestate is discharged to the environment, as is unused

SI 2-2.6. HC000 – Human consumption

HC000 - Human consumption (2016)

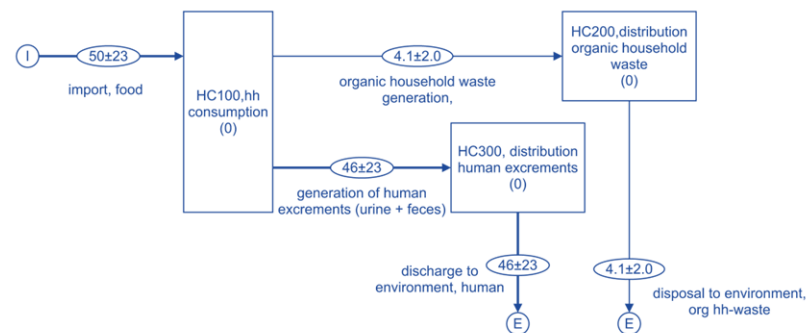
Carbon [Mg/a],
rounded to significant figures



a)

HC000 - Human consumption (2016)

Nitrogen [Mg/a],
rounded to significant figures



b)

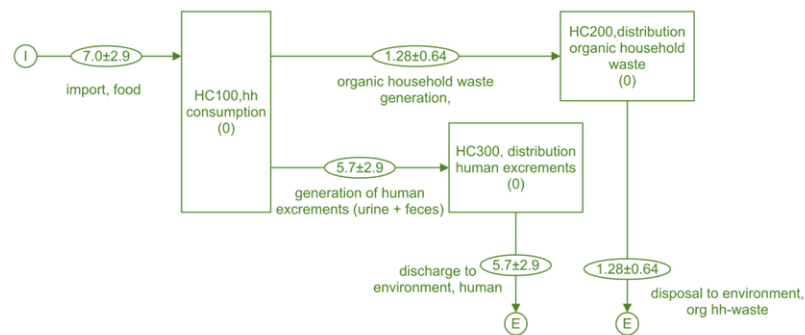
Figure 18 - HC000 - human consumption, & household waste generation [Mg/a] rounded to two significant figures;

a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

Sewer system and waste management system are not fully established.

HC000 - Human consumption (2016)

Phosphorus [Mg/a],
rounded to significant figures

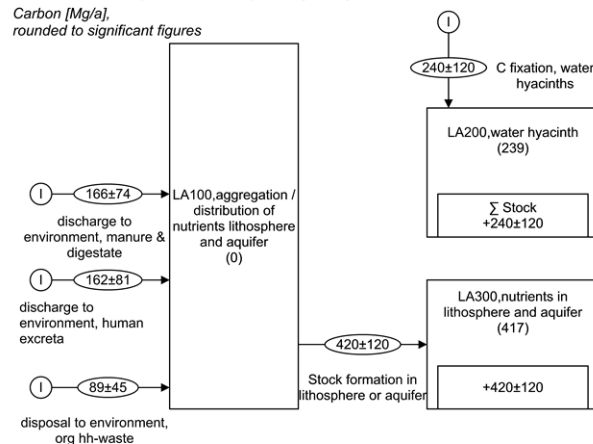


c)

SI 2-2.7. LA000 – Lithosphere/Aquifer

LA000 - Lithosphere and Aquifer (2016)

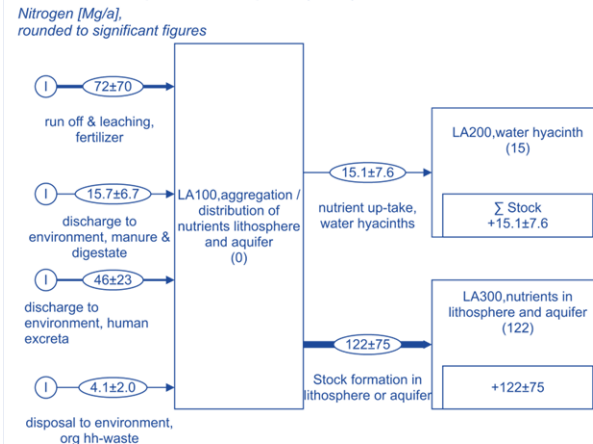
Carbon [Mg/a],
rounded to significant figures



a)

LA000 - Lithosphere and Aquifer (2016)

Nitrogen [Mg/a],
rounded to significant figures



b)

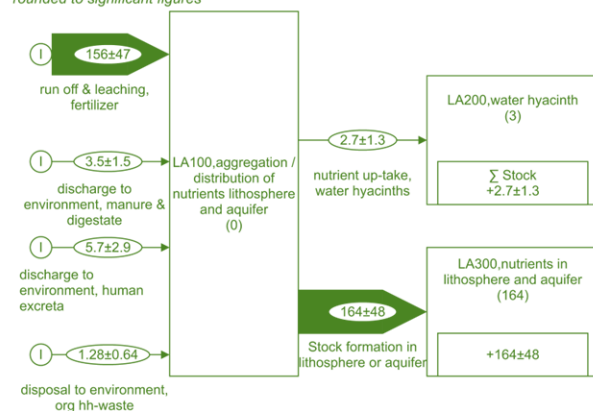
Figure 19 - LA000 - Lithosphere/Aquifer [Mg/a] rounded to two significant figures;

a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

- a) organic carbon emissions to the lithosphere are assumed to end up in aquifer and surface water bodies; water hyacinths grow and assimilate carbon from the atmosphere
- b) nitrogen emissions to the lithosphere are assumed to end up in aquifer and surface water bodies; minor amounts are utilized by water hyacinths;
- c) phosphorus emissions to the lithosphere are assumed to end up in aquifer and surface water bodies; minor amounts are utilized by water hyacinths;

LA000 - Lithosphere and Aquifer (2016)

Phosphorus [Mg/a],
rounded to significant figures



c)

SI 2-2.7.1. LA200 Water hyacinths

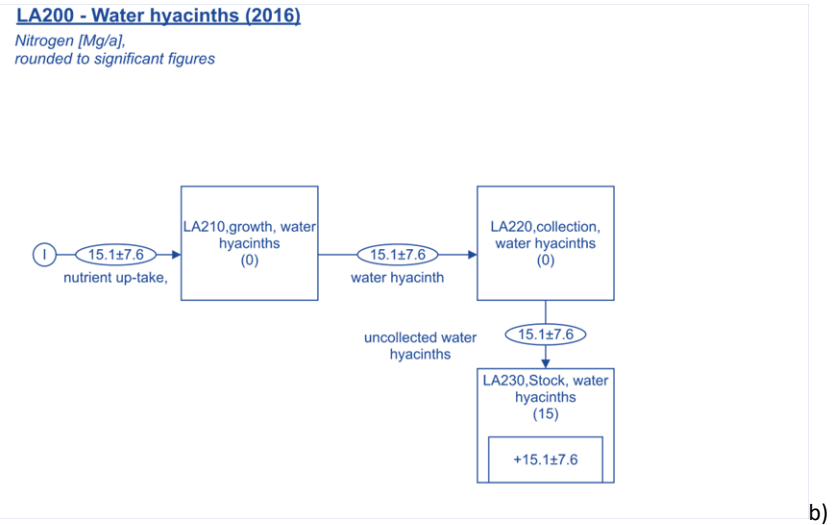
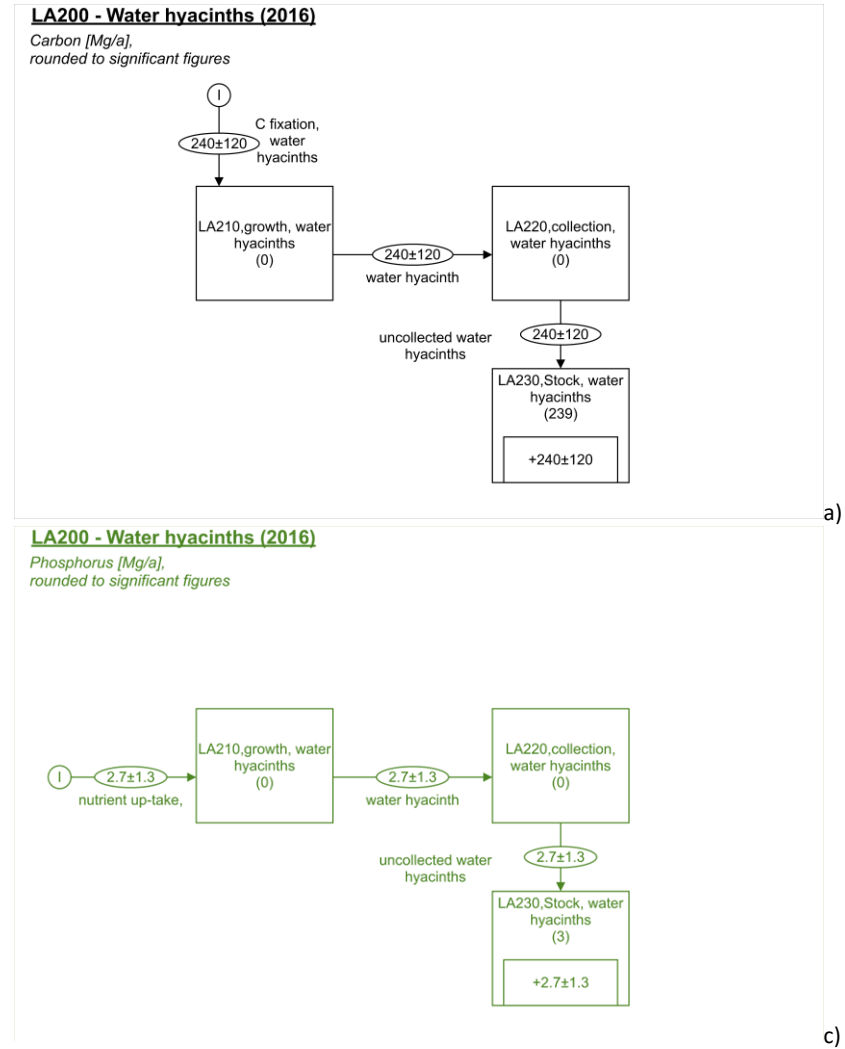


Figure 20 – LA200 – Water hyacinths [Mg/a] rounded to two significant figures;
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);
a) water hyacinths grow and assimilate carbon form the atmosphere
b) minor amounts of nitrogen are utilized by water hyacinths;
c) minor amounts of phosphorus are utilized by water hyacinths;

Remark: it is not possible to set stock and transfer coefficients in one single process;
therefore, this little sub-process had to be created

SI 2-3. Substance flow diagrams – AD scenario

SI 2-3.1. Main-system

Argo-food system Hau My Bac B, Viet Nam

Carbon [Mg/a] 2016
 rounded to significant figures

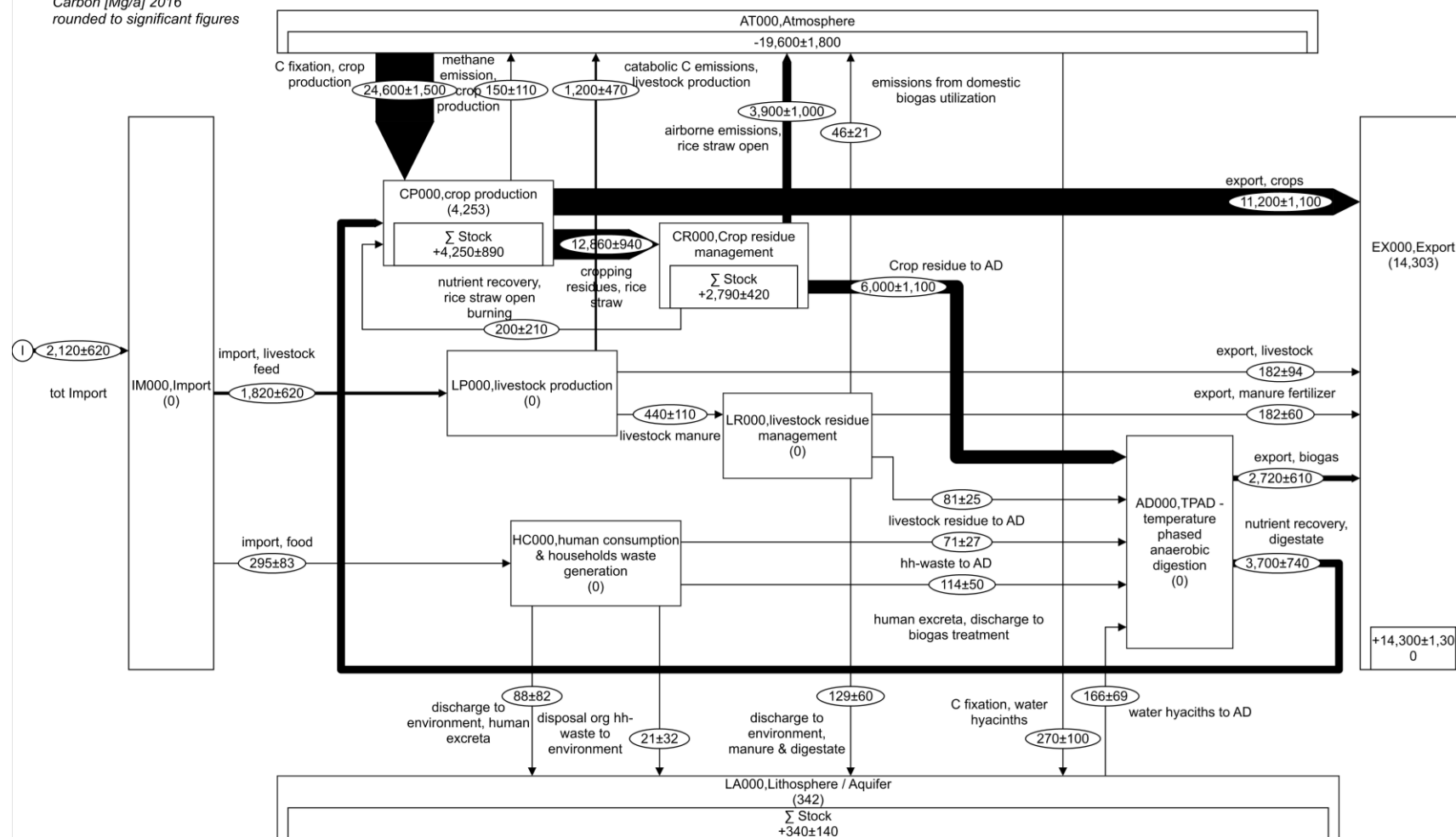


Figure 21 - Main System, Carbon flows [Mg/a], of the agro-food-waste-system in Hậu Mỹ Bắc B in 2016, wit TPAD

Argo-food system Hau My Bac B, Viet Nam

Nitrogen [Mg/a] 2016
 rounded to significant figures

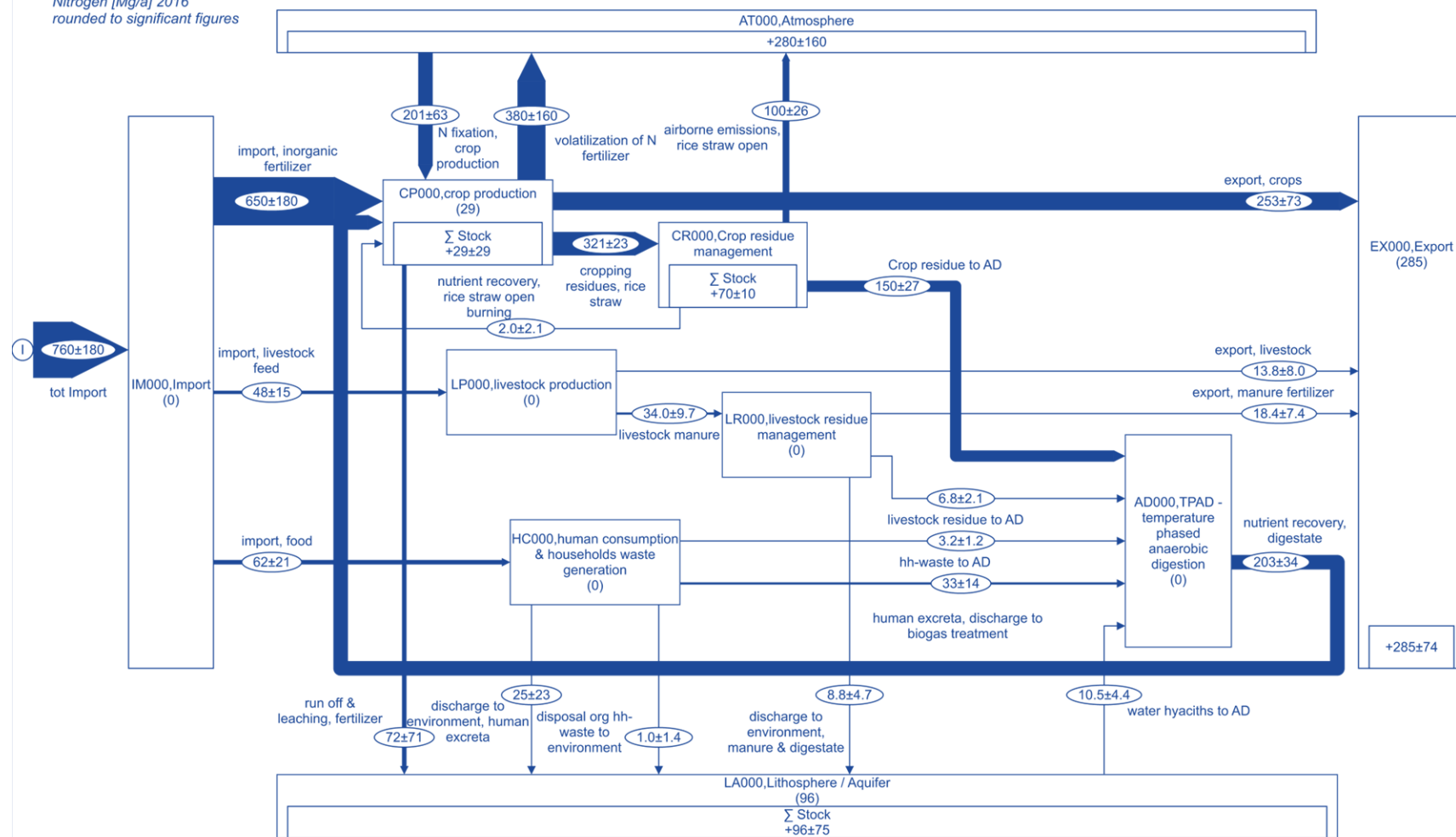


Figure 22 - Main System, Nitrogen flows [Mg/a], of the agro-food-waste-system in Hậu Mỹ Bắc B in 2016, with TPAD

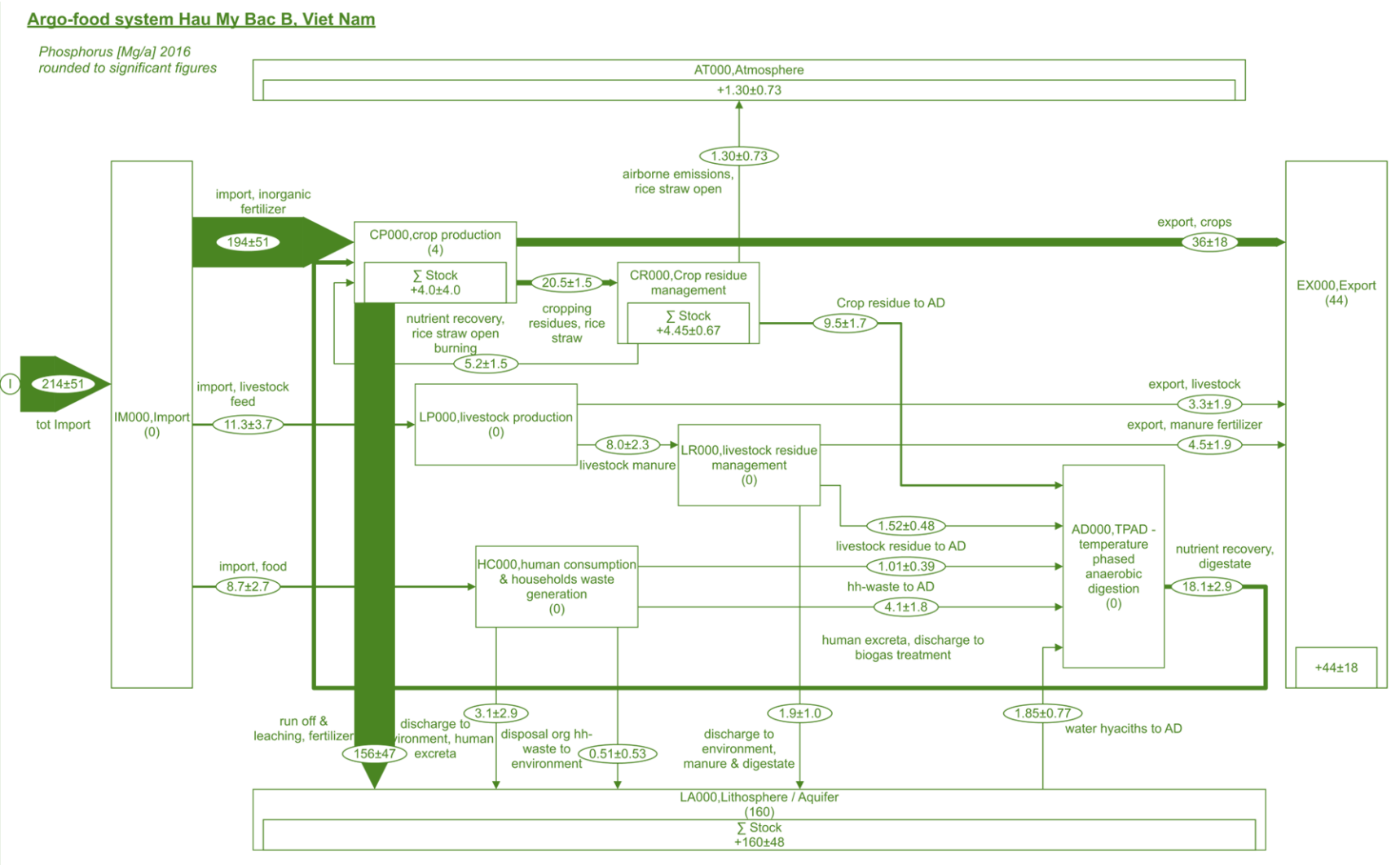
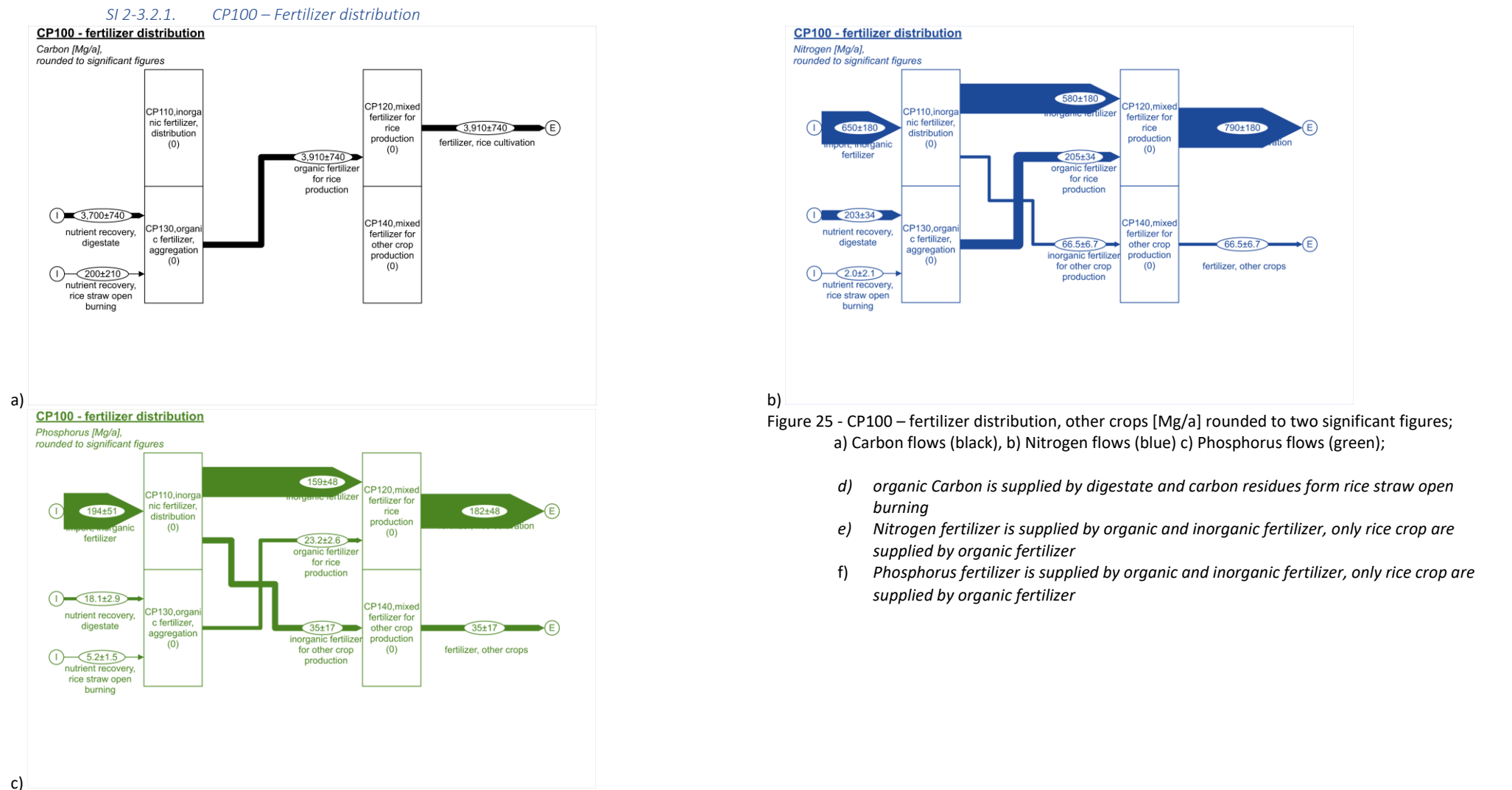


Figure 23 - Main System, Phosphorus flows [Mg/a], of the agro-food-waste-system in Hàu Mỹ Bắc B in 2016, with TPAD

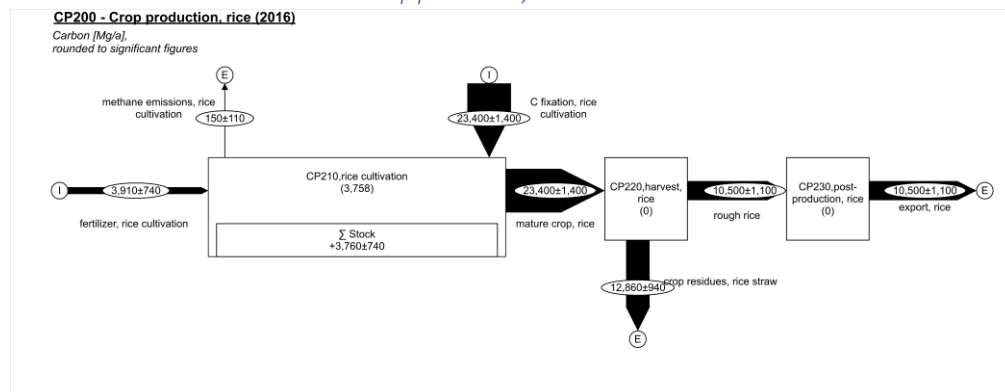
a)



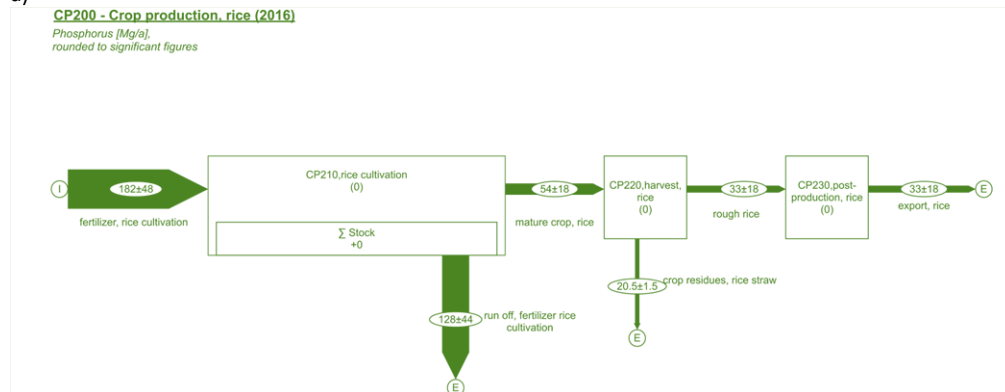
Figure 24 - CP000 - Crop production [Mg/a] rounded to two significant figures;
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);



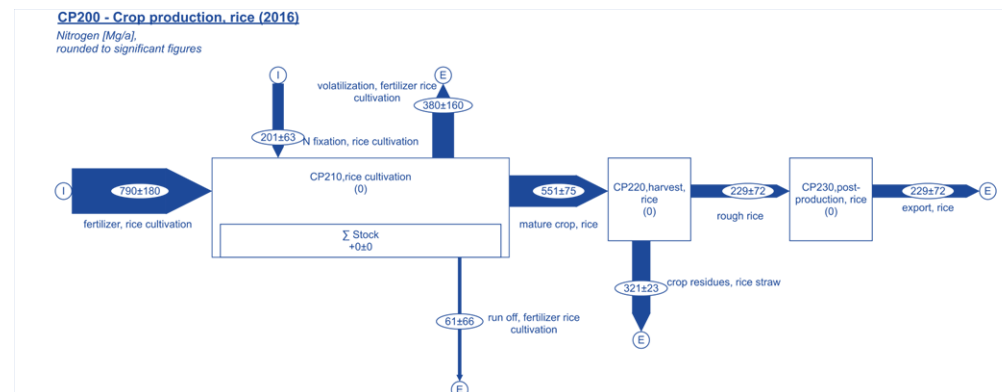
SI 2-3.2.2. CP200 – Crop production, rice



a)



c)

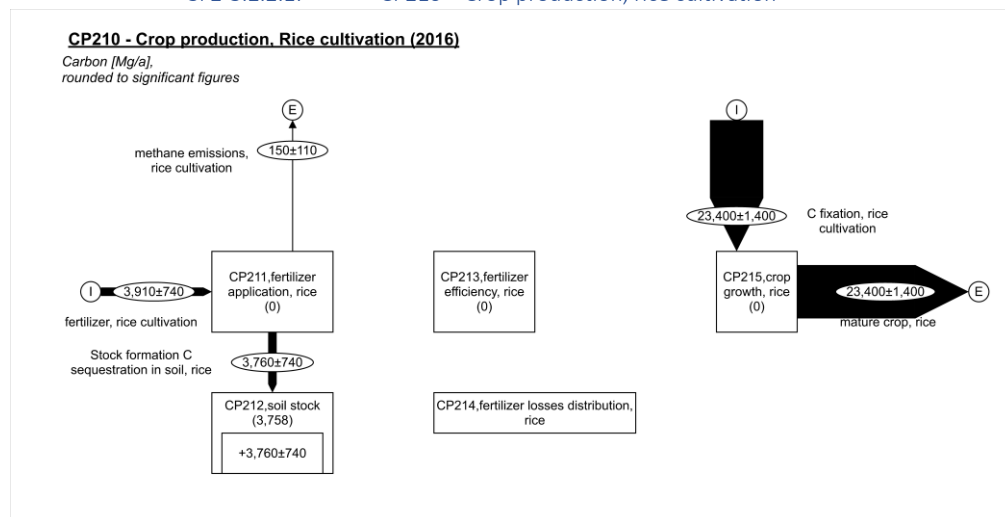


b)

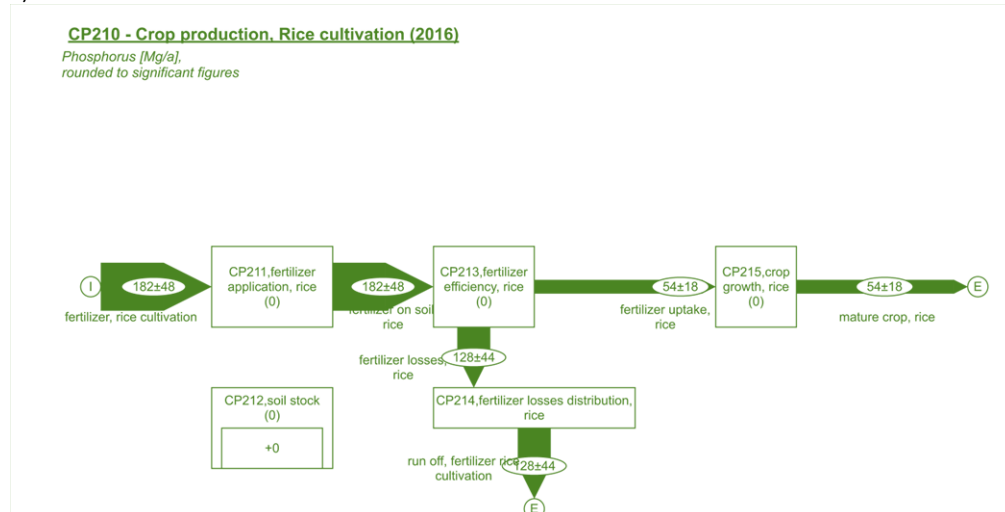
Figure 26 - CP 200 - Crop production, rice [Mg/a] rounded to two significant figures;
 a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

- d) organic Carbon is supplied by biogas digestate, methane emissions from soil organic carbon are emitted, residual organic carbon is going to soil stock; plant only assimilate from inorganic carbon
- e) nitrogen fertilizer (organic and inorganic) is supplied to the field, no soil nitrogen stock is considered; N fixation in rice fields; nutrient use efficiency for nitrogen fertilizer is assumed to be the same for organic and inorganic fertilizers; volatilization of N fertilizer is larger than run off
- f) phosphorus fertilizer (organic and inorganic) is supplied to the field, no soil phosphorus stock is considered; low phosphorus nutrient use efficiency, subject to run off;

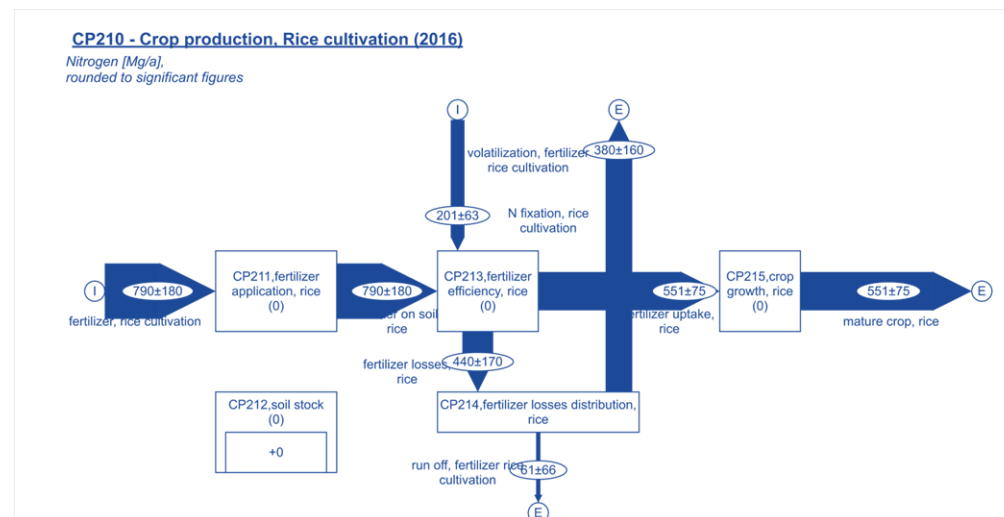
SI 2-3.2.2.1. CP210 – Crop production, rice cultivation



a)



c)



b)

Figure 27 - CP 210 - Crop production, rice cultivation [Mg/a] rounded to two significant figures;

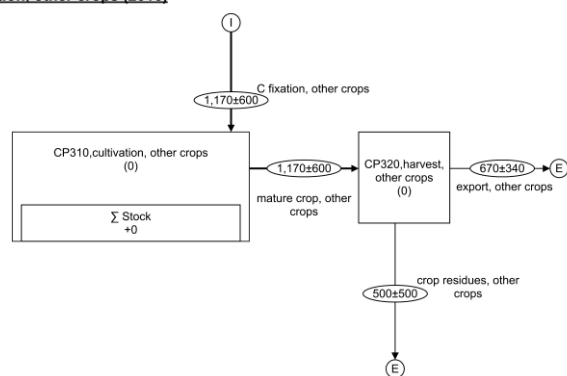
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

- organic Carbon is supplied by biogas digestate, methane emissions from soil organic carbon are emitted, residual organic carbon is going to soil stock; plant only assimilate from inorganic carbon
- nitrogen fertilizer (organic and inorganic) is supplied to the field, no soil nitrogen stock is considered; N fixation in rice fields; nutrient use efficiency for nitrogen fertilizer is assumed to be the same for organic and inorganic fertilizers; volatilization of N fertilizer is larger than run off
- phosphorus fertilizer (organic and inorganic) is supplied to the field, no soil phosphorus stock is considered; low phosphorus nutrient use efficiency, subject to run off;

SI 2-3.2.3. CP300 - Crop production, other crops

CP300 - crop production, other crops (2016)

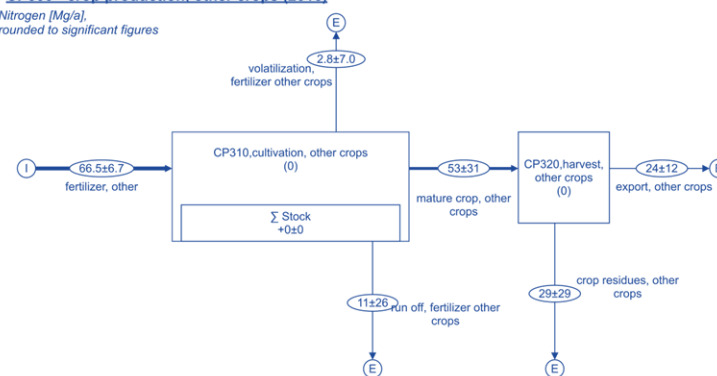
Carbon [Mg/a],
rounded to significant figures



a)

CP300 - crop production, other crops (2016)

Nitrogen [Mg/a],
rounded to significant figures



b)

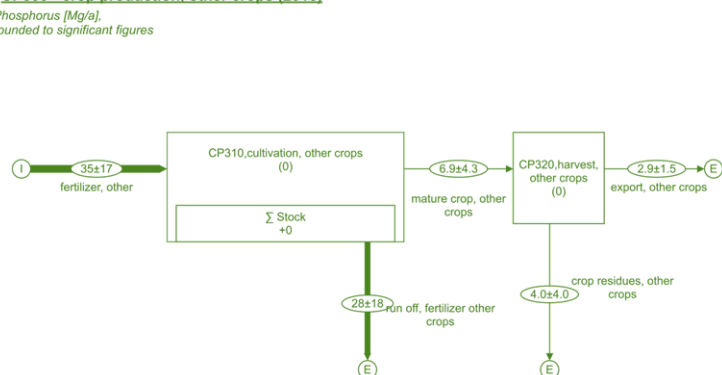
Figure 28- CP 300 - Crop production, other crops [Mg/a] rounded to two significant figures;

a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

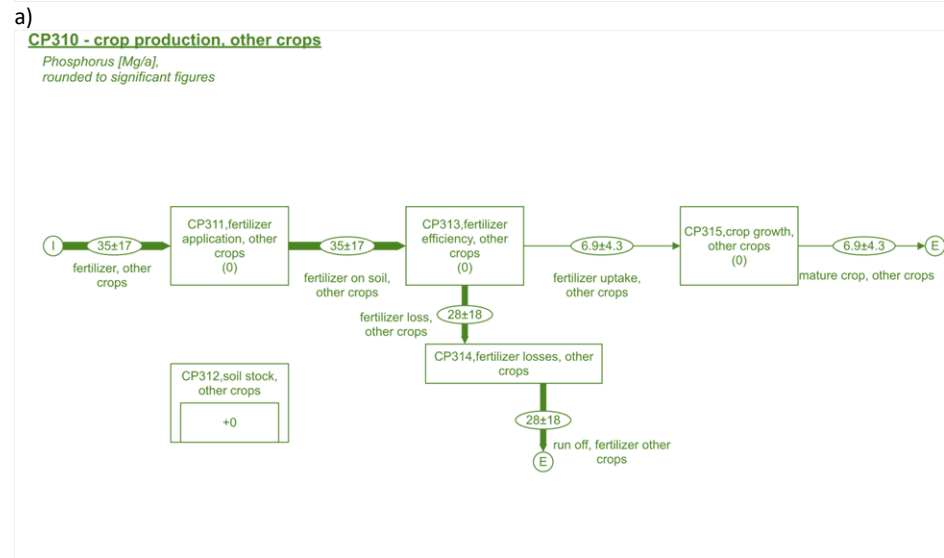
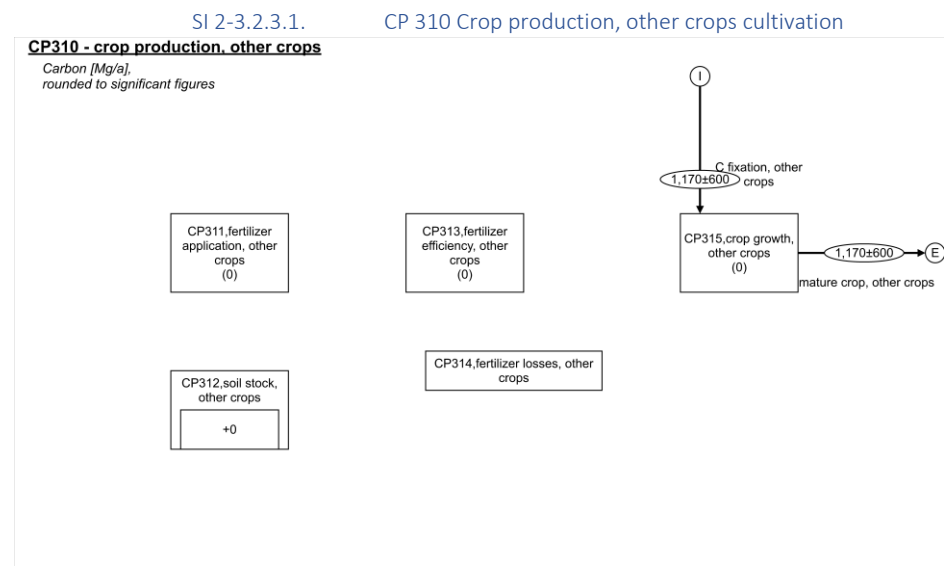
- a) no organic carbon is supplied to other crops, assimilation of inorganic carbon, distribution of crop product and crop residue according to average residue-to-product rate (RPR)
- b) inorganic nitrogen fertilizer is supplied to the field, nitrogen loss from fertilizer run off and volatilization, distribution of crop and crop residue according to average residue-to-product rate (RPR)
- c) inorganic phosphorus fertilizer is supplied to the field; phosphorus fertilizer run off; distribution of crop and crop residue according to average residue-to-product rate (RPR)

CP300 - crop production, other crops (2016)

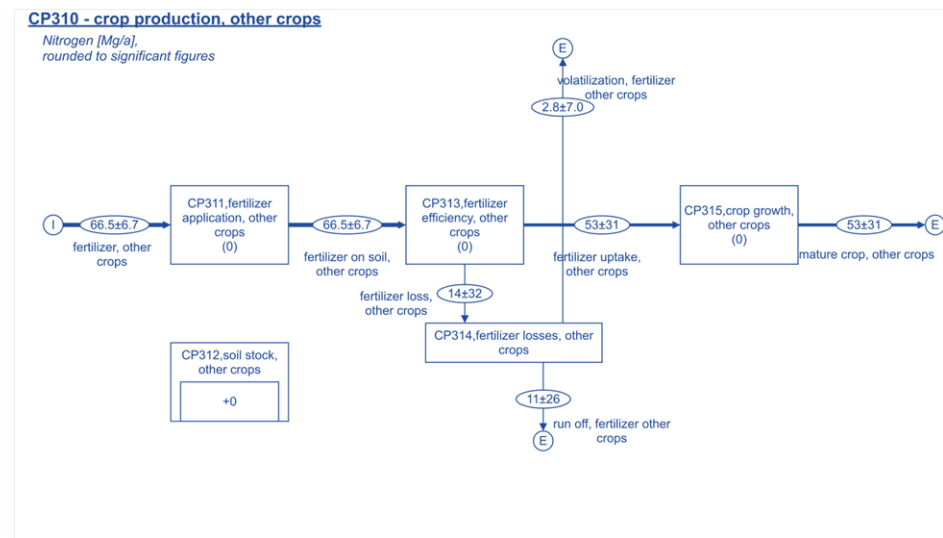
Phosphorus [Mg/a],
rounded to significant figures



c)



c)



b)

Figure 29 - CP 310 - Crop production, other crops [Mg/a] rounded to two significant figures;
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

a) no organic carbon is supplied to other crops; no soil carbon stock; assimilation of inorganic carbon
b) inorganic nitrogen fertilizer is supplied to the field, nitrogen loss from fertilizer run off and volatilization, fixation of atmospheric nitrogen is assumed to be not representative and not significant
c) inorganic phosphorus fertilizer is supplied to the field; phosphorus fertilizer run off;

SI 2-3.2.4. CP400 – Air exchange, C, N fixation and emissions crop production, aggregation

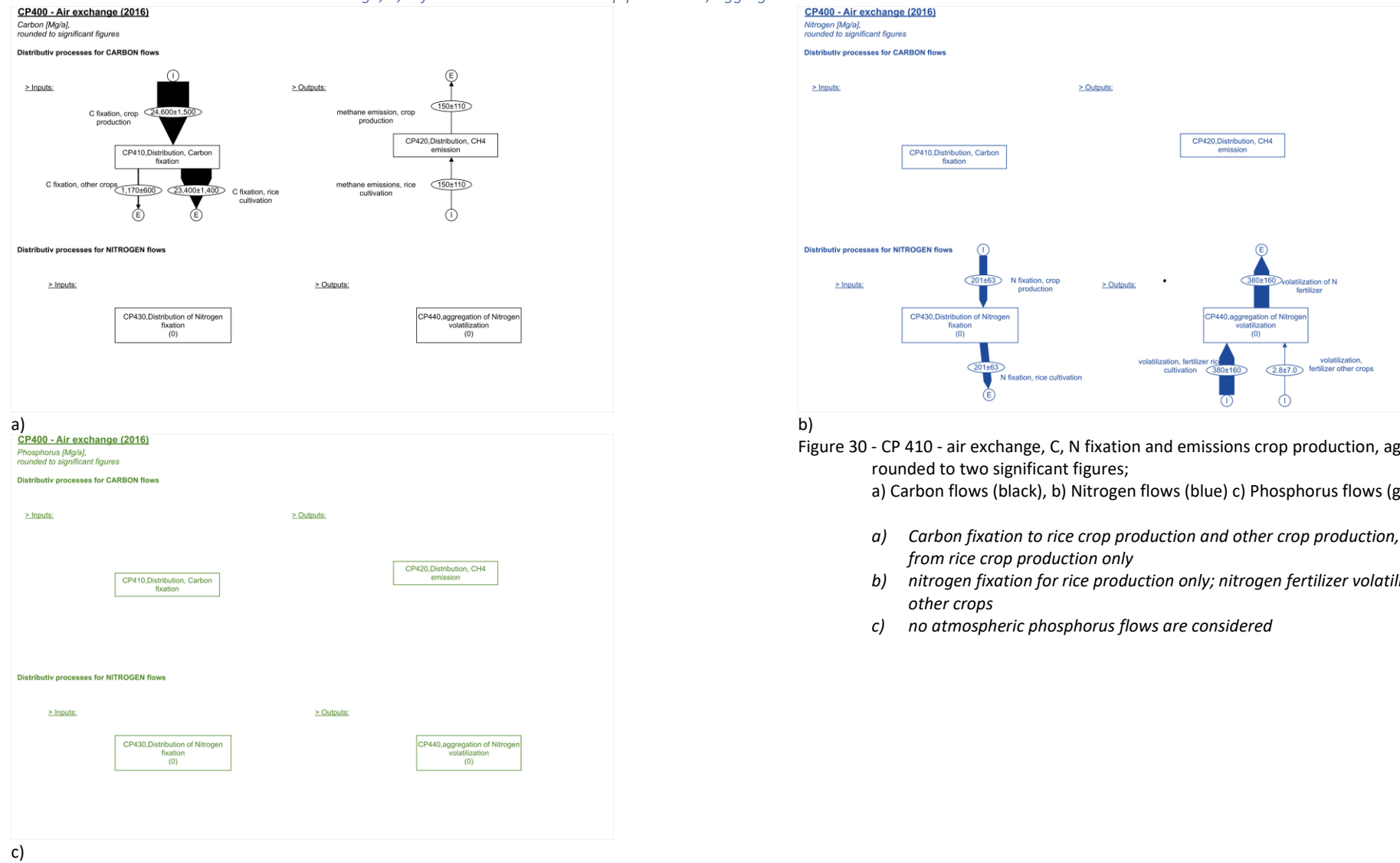


Figure 30 - CP 410 - air exchange, C, N fixation and emissions crop production, aggregation [Mg/a] rounded to two significant figures;

- a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);
- a) Carbon fixation to rice crop production and other crop production, Carbon emission from rice crop production only
 - b) nitrogen fixation for rice production only; nitrogen fertilizer volatilization for rice and other crops
 - c) no atmospheric phosphorus flows are considered

SI 2-3.2.5. CP700 – Residues crop production, collection

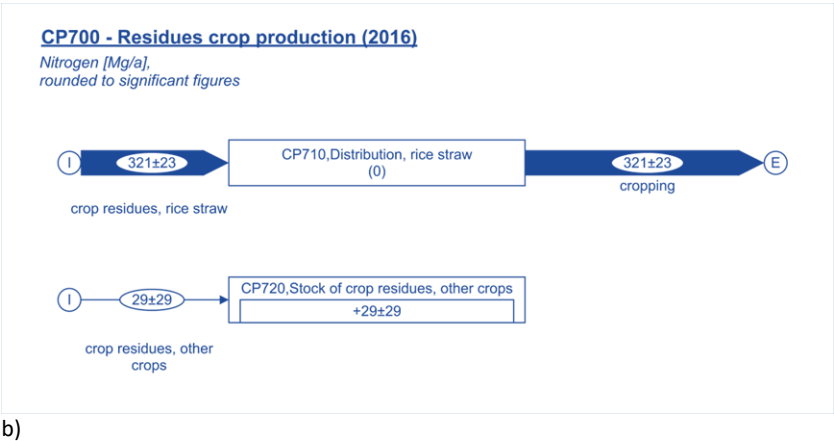
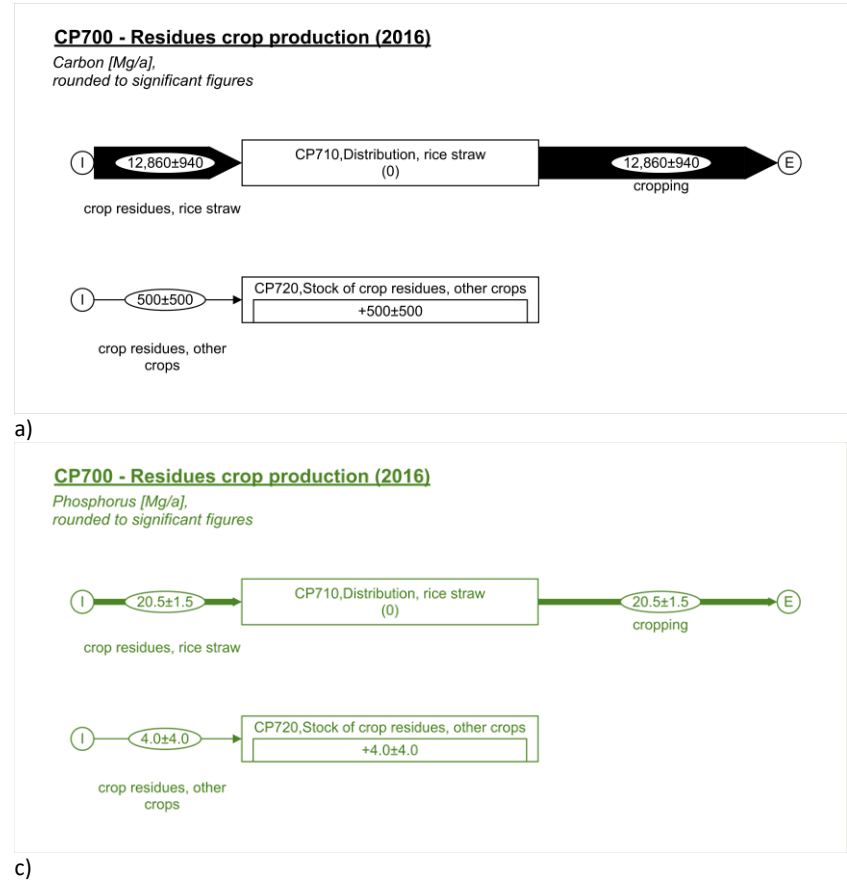
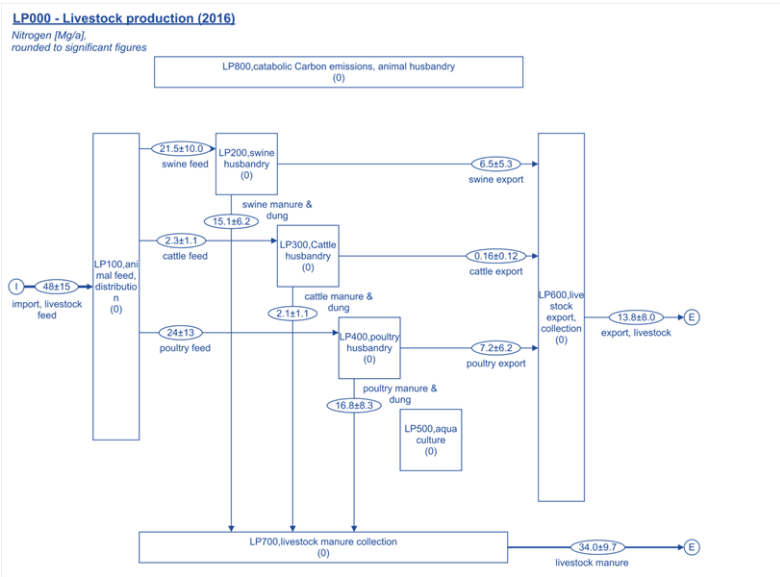
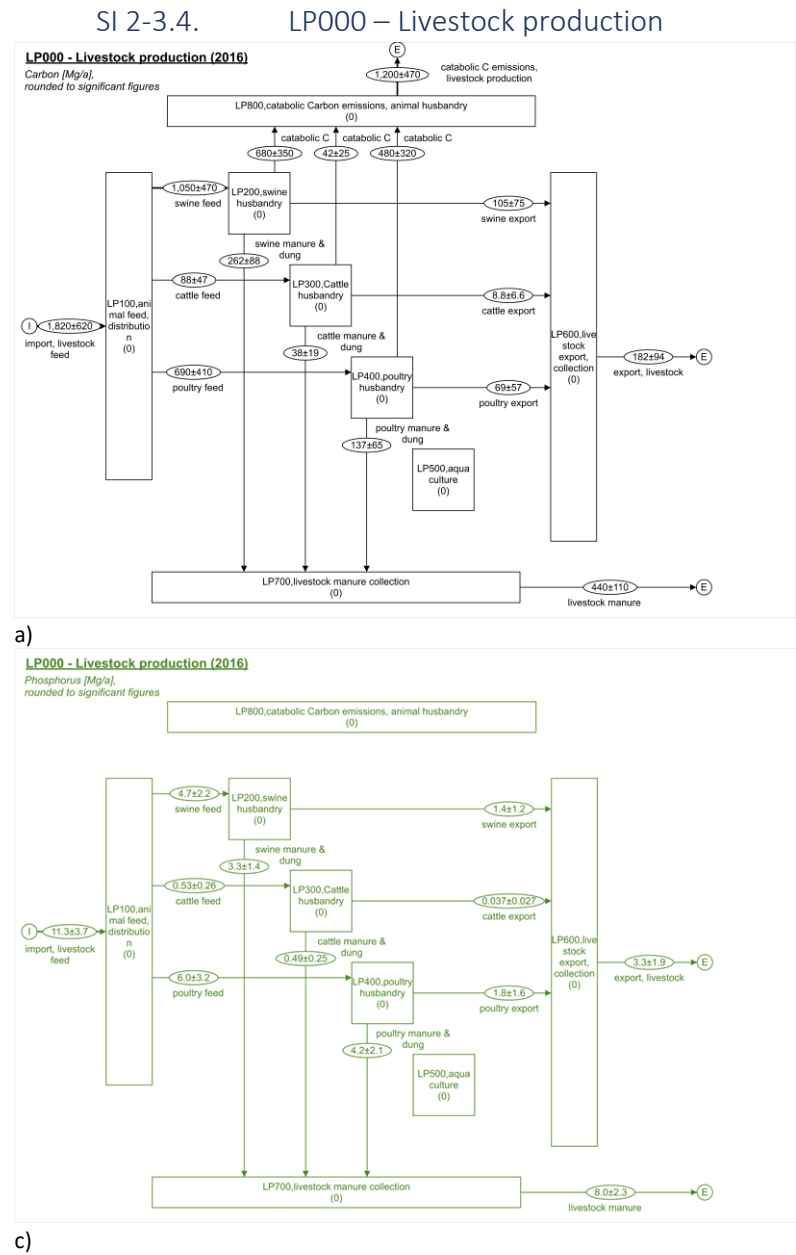


Figure 31 - CP 700 – Residue crop production [Mg/a] rounded to two significant figures;
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

Flows for rice crop residues and other crop residues are separated. Other crop residues do not arise in larger quantities and are assumed not to be further utilized. Rice crop residues are subjected to crop residue management.



a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

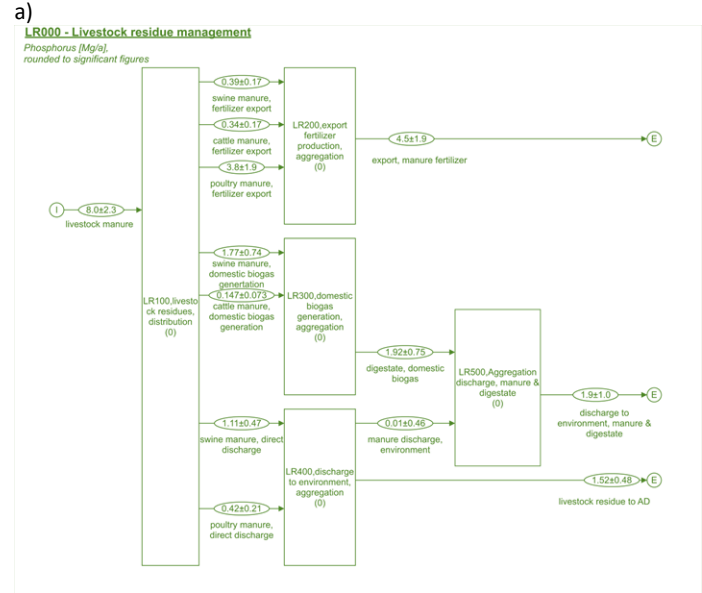
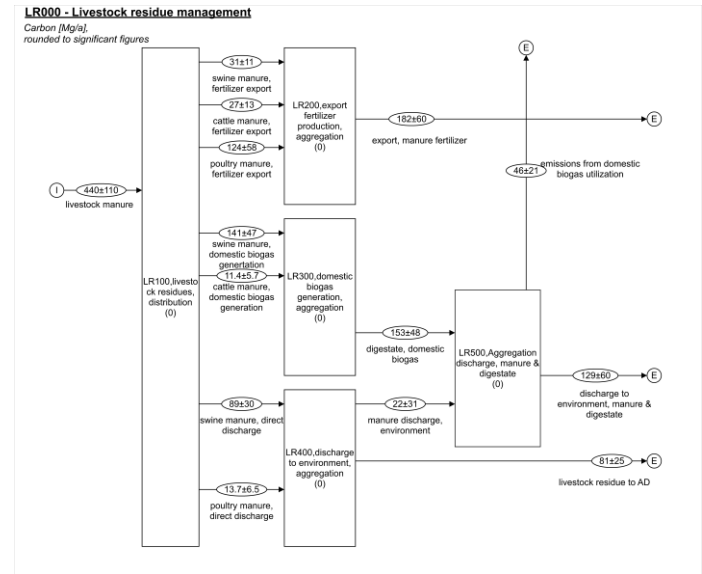
d) Catabolic Carbon flow represent the metabolic losses or carbon from the livestock, assuming about 10 % of the Carbon intake get's assimilated. The residual carbon is excreted as manure & dung, or contained in the livestock products

e) nitrogen from feed intake is distrusted to manure & dung as well as livestock products (further information ca be found in SI-1 modelling data)

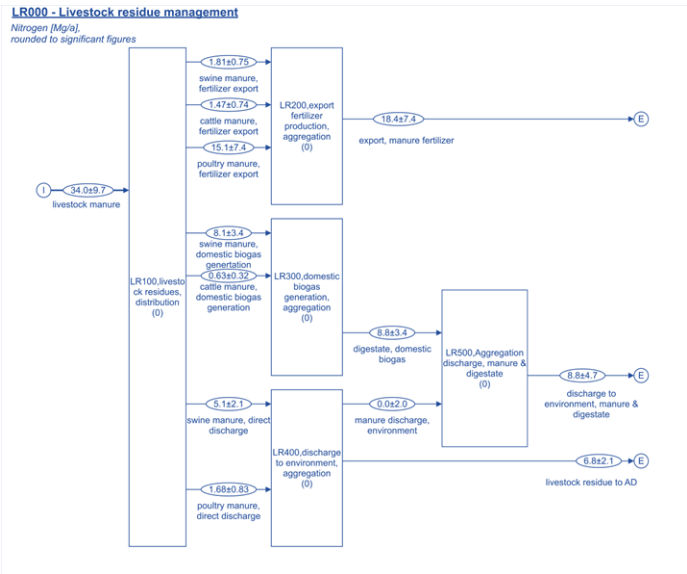
f) phosphorus from feed intake is distrusted to manure & dung as well as livestock products (further information ca be found in SI-1 modelling data)

LP500 aqua culture is not considered, due to little data

SI 2-3.5. LR000 – Livestock residue management



c)

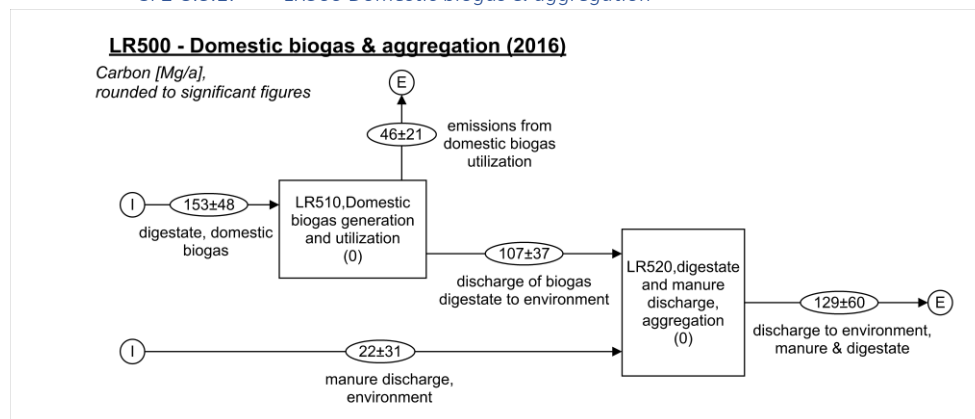


b)

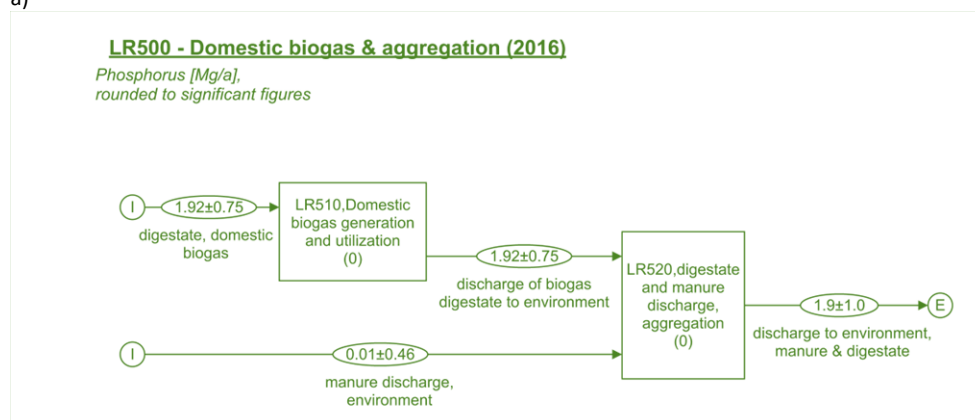
Figure 34 - LR000 – Livestock residue management [Mg/a] rounded to two significant figures; a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

Linear relationships are used to disaggregate the aggregated manure & dung flow (LP700LR100) by setting the reported species-specific utilization ratios as factors for the species-specific manure & dung flows (LP200LP700, LP300LP700, LP400LP700) in livestock production process LP000.

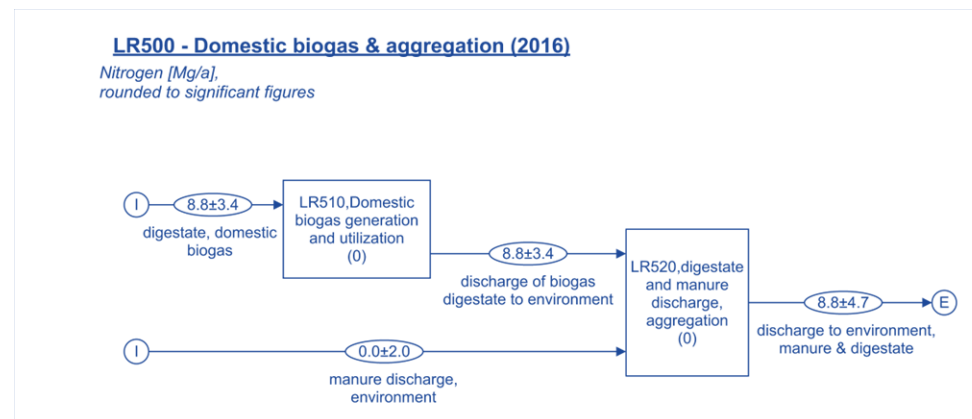
SI 2-3.5.1. LR500 Domestic biogas & aggregation



a)



c)



b)

Figure 35 - LR5000 – Domestic biogas & aggregation [Mg/a] rounded to two significant figures;

a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

- a) biogas from domestic biogas plants is assumed to be utilized or released to the atmosphere (for this study it makes no difference for the environment is does), residual carbon in the digestate is discharged to the environment, as is unutilized manure
- b) nitrogen in the digestate is discharged to the environment, as is unutilized manure
- c) phosphorus in the digestate is discharged to the environment, as is unutilized manure

SI 2-3.6. HC000 – human consumption, & household waste generation

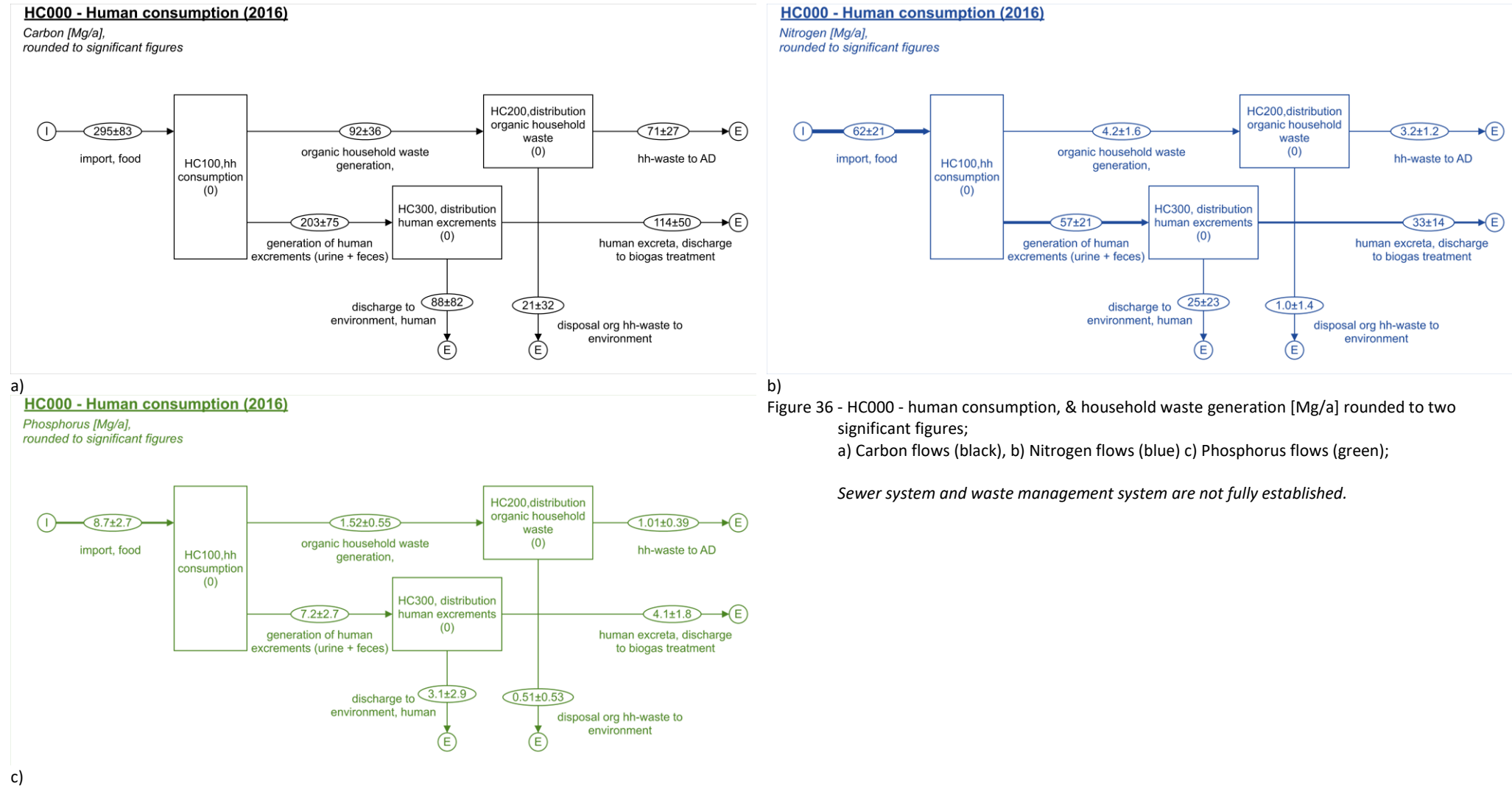
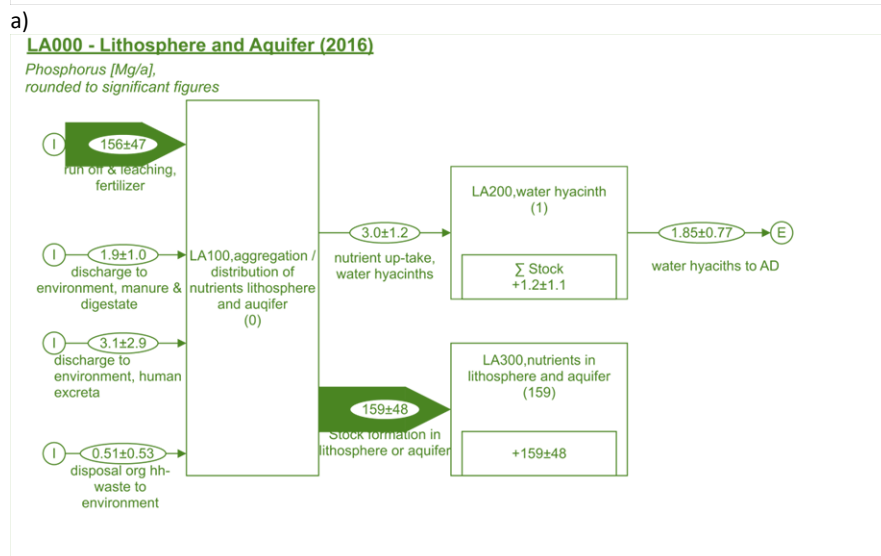
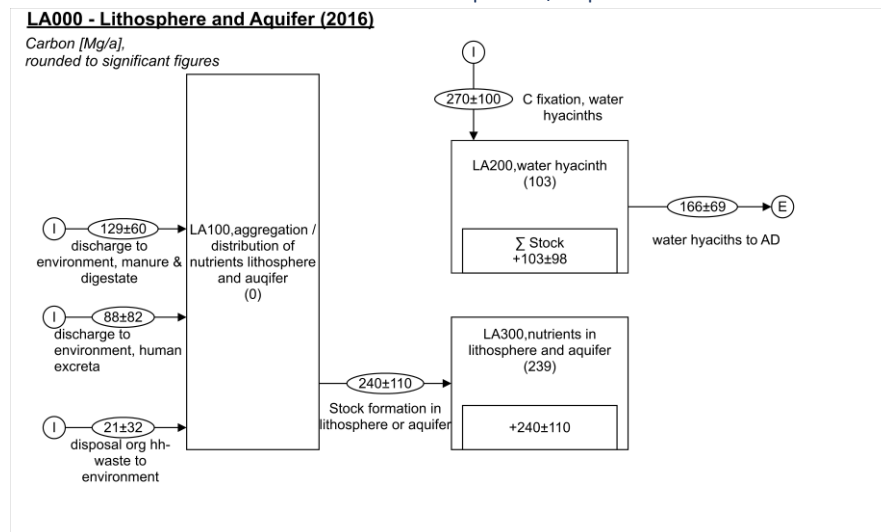
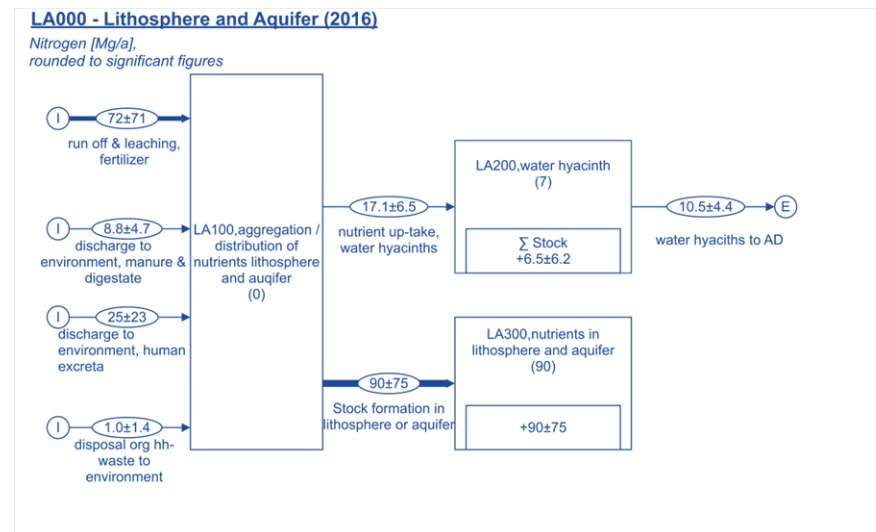


Figure 36 - HC000 - human consumption, & household waste generation [Mg/a] rounded to two significant figures;
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);
Sewer system and waste management system are not fully established.

SI 2-3.7. LA000 – Lithosphere/Aquifer



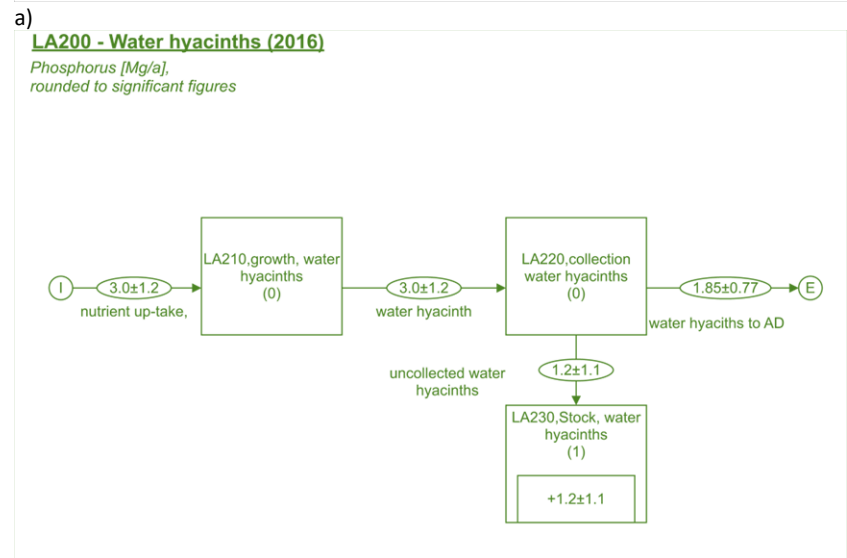
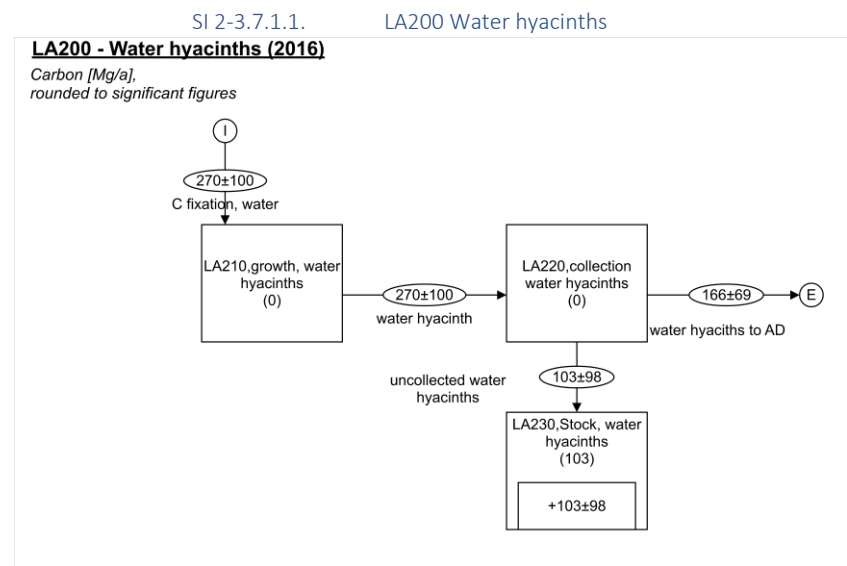
c)



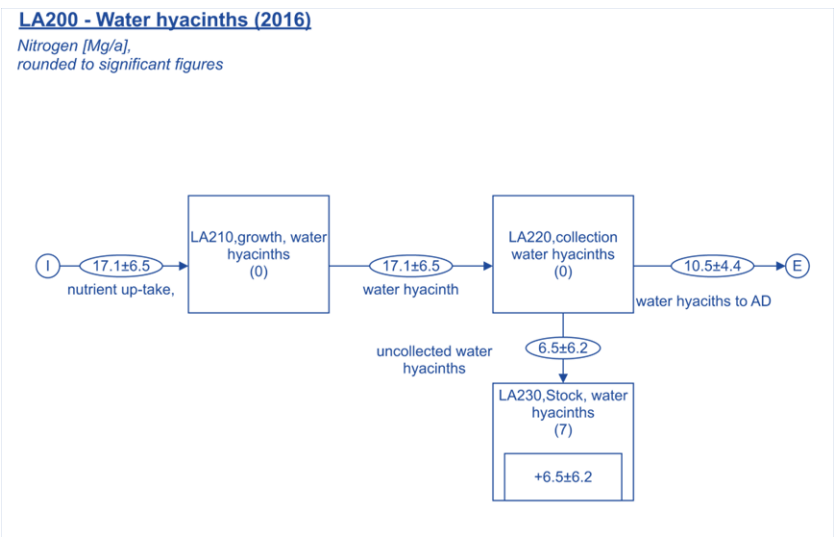
b)

Figure 37 - LA000 - Lithosphere/Aquifer [Mg/a] rounded to two significant figures;
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

- organic carbon emissions to the lithosphere are assumed to end up in aquifer and surface water bodies; water hyacinths grow and assimilate carbon from the atmosphere
- nitrogen emissions to the lithosphere are assumed to end up in aquifer and surface water bodies; minor amounts are utilized by water hyacinths; some of them are potential substrates for AD.
- phosphorus emissions to the lithosphere are assumed to end up in aquifer and surface water bodies; minor amounts are utilized by water hyacinths; some of them are potential substrates for AD.



c)

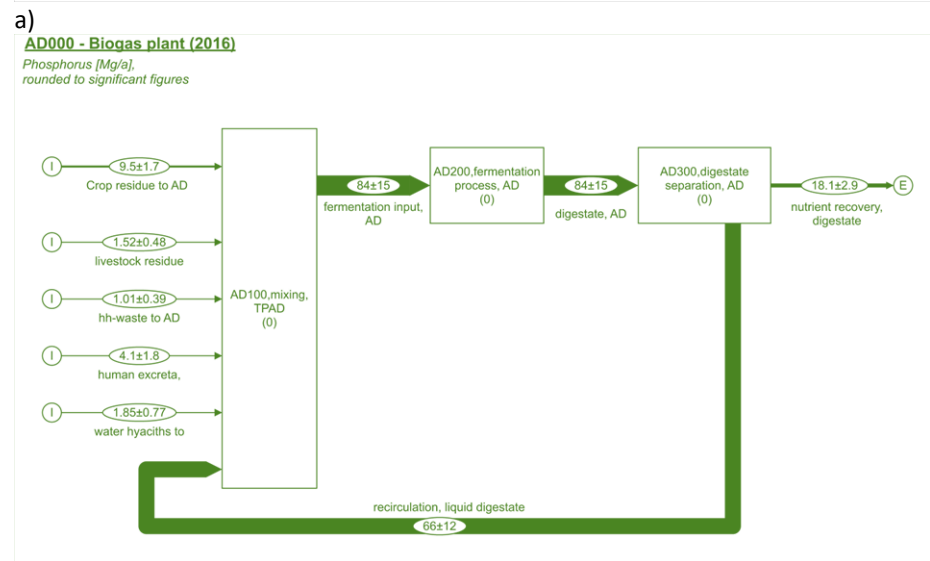
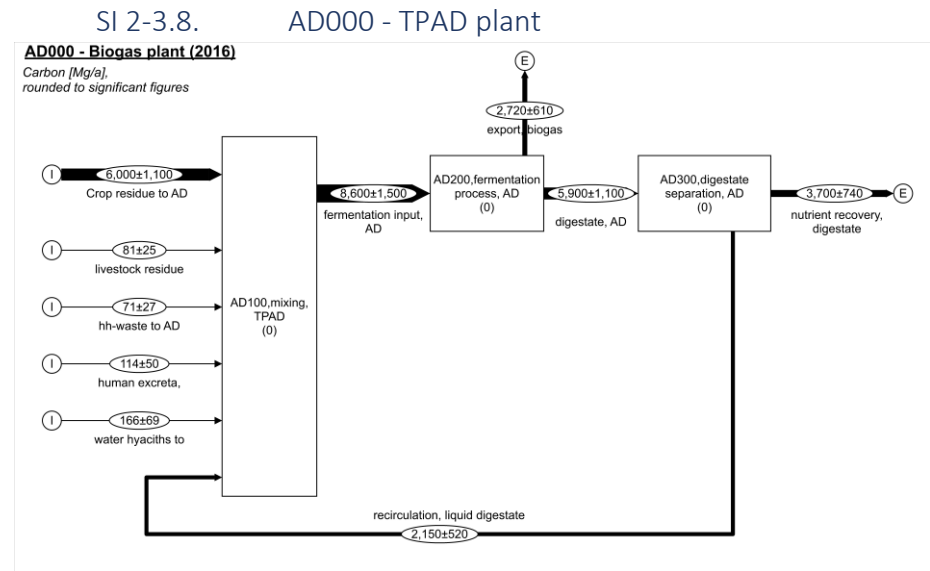


b)

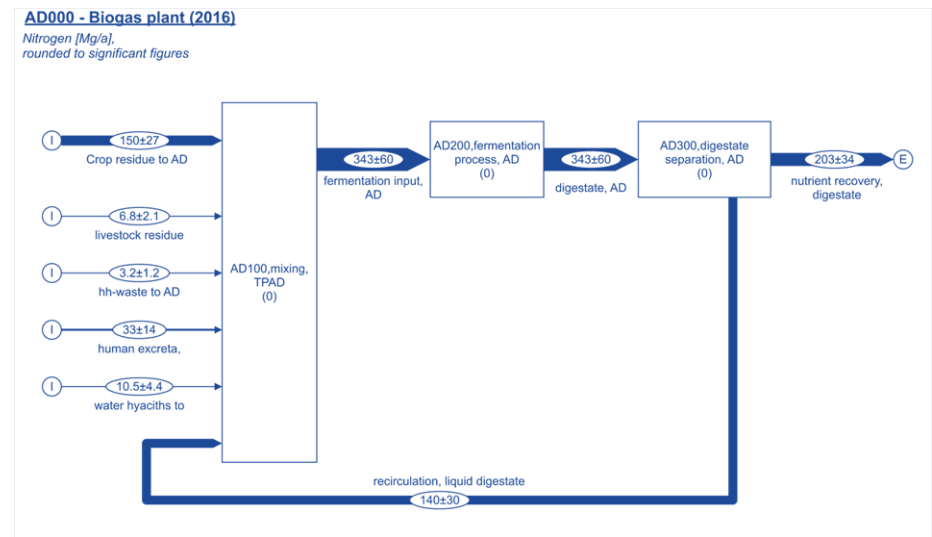
Figure 38 - LA200 - Water hyacinths [Mg/a] rounded to two significant figures;
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

- a) water hyacinths grow and assimilate carbon form the atmosphere
- b) minor amounts of nitrogen are utilized by water hyacinths; some of them are potential substrates for biogasification.
- c) minor amounts of phosphorus are utilized by water hyacinths; some of them are potential substrates for biogasification. e

Remark: it is not possible to set stock and transfer coefficients in one single process; therefore, this little sub-process had to be created



c)



b)

Figure 39 - BG000 – Biogas plant [Mg/a] rounded to two significant figures;
a) Carbon flows (black), b) Nitrogen flows (blue) c) Phosphorus flows (green);

- a) Biogas is collected and utilized outside the system boundary
- b) No significant quantities of ammonia are assumed to be contained in the Biogas, thus the Nitrogen in biogas has been neglected; recycling of liquid digestate is crucial for the biogas process Nitrogen balance
- c) No Phosphorus is assumed to be released with the biogas;

Linear relationships are used to maintain the material composition between the substrates, while also maintaining the appropriate C/N ratio for the fermentation of rice straw. This solution is only a crutch but at the time the solution that was possible in the capacities of STAN.

For Further documentation of the relationships see Supporting Information SI 1-1.6 List of relationships, Table 6: list of additional relationships in STAN

SI 2-4. Uncertainty assessment

The resulting model uncertainties (after error propagation and data reconciliation) have been assessed according to Klingmair et al. (2016) if choose too optimistically or pessimistically. Here x_n represents the input flow value and $\hat{x}_n$ the reconciled flow value.

Layer	Flow	Flow name	Input (see SI 1)			Calculated / Reconciled		Pessimistic / optimistic uncertainty values $= \left \frac{x_n - \hat{x}_n}{x_n} \right $
			Mass flow x_n	± Mass flow	Rel.STD	Mass flow $\hat{x}_n$	± Mass flow	
C	LP300LP700	cattle manure & dung	38,0	19,0	50%	38,0	19,0	0,00
C	CP320CP720	crop residues, other crops	495,5	495,5	100%	495,5	495,5	0,00
C	CP220CP710	crop residues, rice straw	13283,0	1328,3	10%	12927,1	935,9	0,27
C	CP320CP600	export, other crops	673,7	336,8	50%	673,7	336,8	0,00
C	HC100HC300	generation of human excrements (urine + feces)	161,7	80,9	50%	206,0	69,4	0,55
C	CP211CP402	methane emissions, rice cultivation	150,0	112,5	75%	150,0	112,5	0,00
C	HC100HC200	organic household waste generation,	89,4	44,7	50%	94,7	39,0	0,12
C	LP400LP700	poultry manure & dung	130,0	65,0	50%	131,3	64,8	0,02
C	CP220CP230	rough rice	10541,0	1054,1	10%	10541,0	1054,1	0,00
C	LP200LP700	swine manure & dung	202,0	101,0	50%	212,8	90,7	0,11
C	LA210LA220	water hyacinth	239,0	119,5	50%	263,0	103,8	0,20
N	LP300LP700	cattle manure & dung	2,1	1,1	50%	2,1	1,1	0,00
N	CP320CP720	crop residues, other crops	29,0	29,0	100%	29,0	29,0	0,00
N	CP220CP710	crop residues, rice straw	345,4	34,5	10%	323,2	23,4	0,64
N	CP320CP600	export, other crops	23,6	11,8	50%	23,6	11,8	0,00
N	CP104CP311	fertilizer, other crops	66,5	6,7	10%	66,5	6,7	0,00
N	CP102CP211	fertilizer, rice cultivation	660,6	218,0	33%	788,9	178,3	0,59
N	HC100HC300	generation of human excrements (urine + feces)	45,6	22,8	50%	58,4	19,6	0,56
N	CP403CP213	N fixation, rice cultivation	190,4	63,5	33%	201,2	62,6	0,17
N	HC100HC200	organic household waste generation,	4,1	2,0	50%	4,3	1,8	0,12
N	LP400LP700	poultry manure & dung	16,8	8,4	50%	17,1	8,3	0,03
N	CP220CP230	rough rice	258,2	77,5	30%	229,2	72,1	0,38
N	LP200LP700	swine manure & dung	15,2	7,6	50%	16,0	7,0	0,10
N	LA210LA220	water hyacinth	15,1	7,6	50%	16,6	6,6	0,20
P	LP300LP700	cattle manure & dung	0,5	0,2	50%	0,5	0,2	0,00
P	CP320CP720	crop residues, other crops	4,0	4,0	100%	4,0	4,0	0,00

Layer	Flow	Flow name	Input (see SI 1)			Calculated / Reconciled		Pessimistic / optimistic uncertainty values $= \left \frac{x_n - \hat{x}_n}{x_n} \right $
			Mass flow x_n	± Mass flow	Rel.STD	Mass flow $\hat{x}_n$	± Mass flow	
P	CP220CP710	crop residues, rice straw	31,4	15,7	50%	20,6	1,5	0,69
P	CP320CP600	export, other crops	2,9	1,5	50%	2,9	1,5	0,00
P	CP104CP311	fertilizer, other crops	34,9	17,4	50%	34,9	17,4	0,00
P	CP102CP211	fertilizer, rice cultivation	123,4	40,7	33%	144,3	37,4	0,51
P	HC100HC300	generation of human excrements (urine + feces)	5,7	2,9	50%	7,4	2,5	0,56
P	HC100HC200	organic household waste generation,	1,3	0,6	50%	1,4	0,6	0,11
P	LP400LP700	poultry manure & dung	4,3	2,1	50%	4,3	2,1	0,04
P	CP220CP230	rough rice	47,0	23,5	50%	24,9	16,1	0,94
P	LP200LP700	swine manure & dung	3,3	1,7	50%	3,5	1,5	0,09
P	LA210LA220	water hyacinth	2,7	1,3	50%	2,9	1,2	0,19

Reference

Klinglmair M, Zoboli O, Laner D, Rechberger H, Astrup TF, Scheutz C (2016) The effect of data structure and model choices on MFA results: A comparison of phosphorus balances for Denmark and Austria. Resources, Conservation and Recycling 109:166–175. doi: 10.1016/j.resconrec.2016.03.009