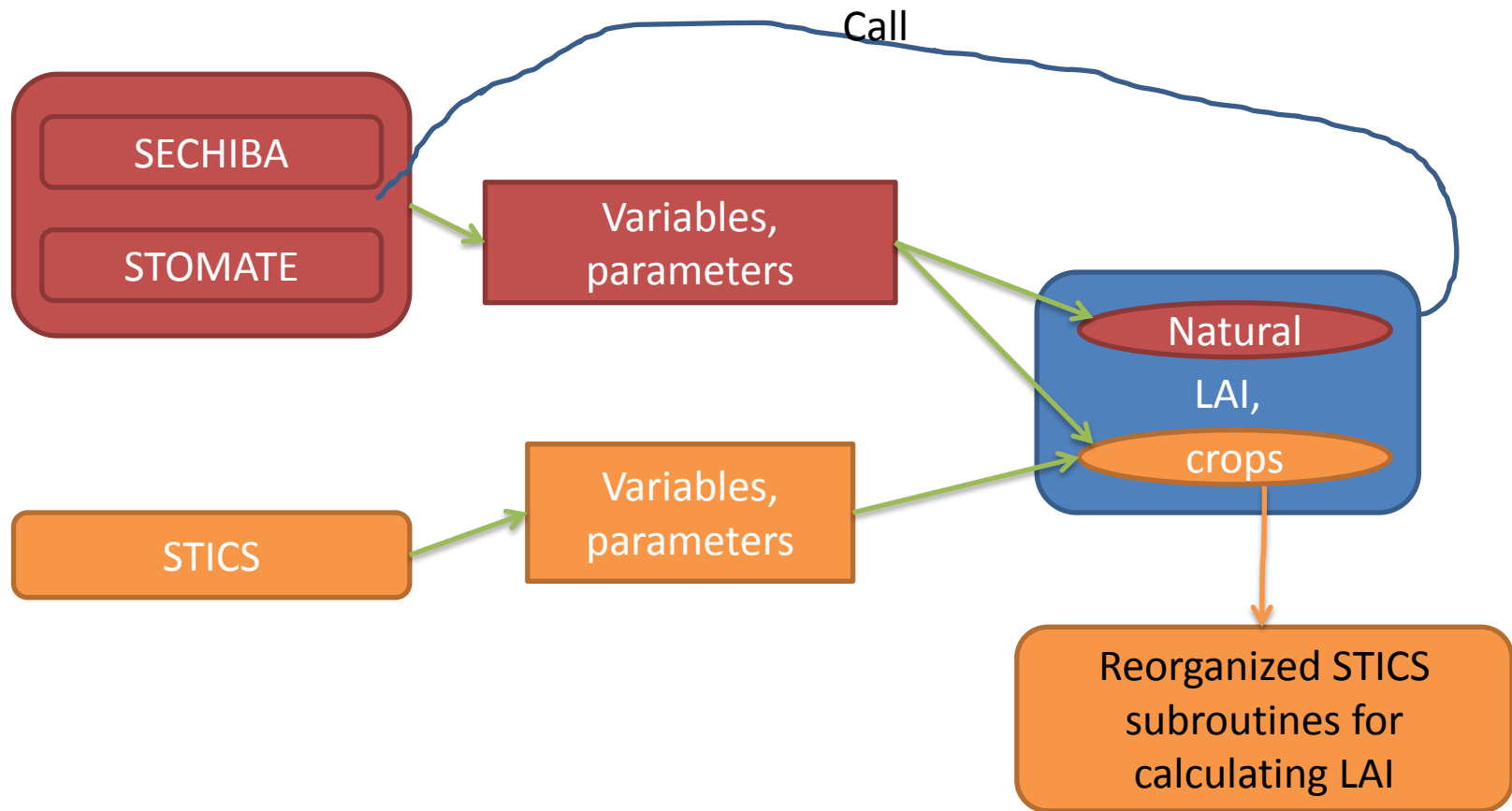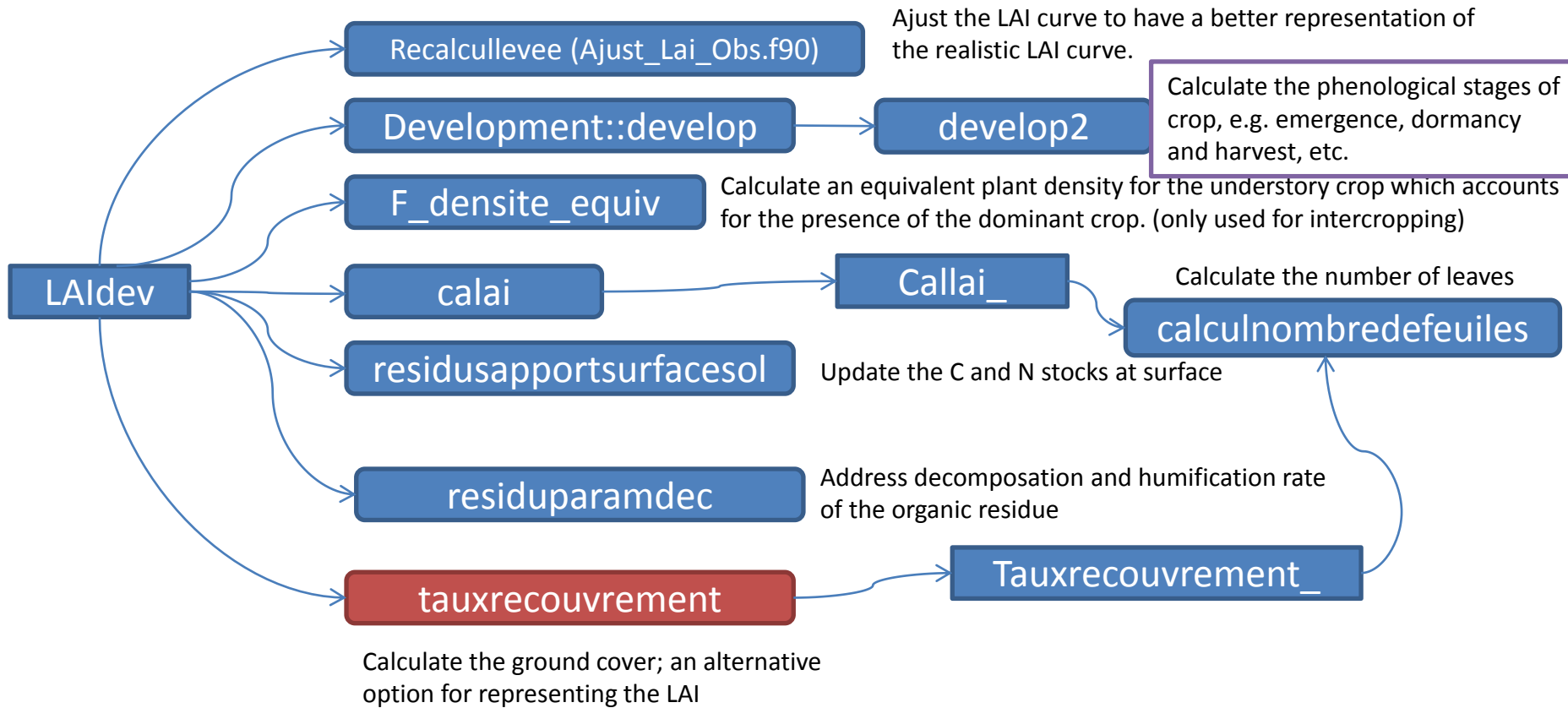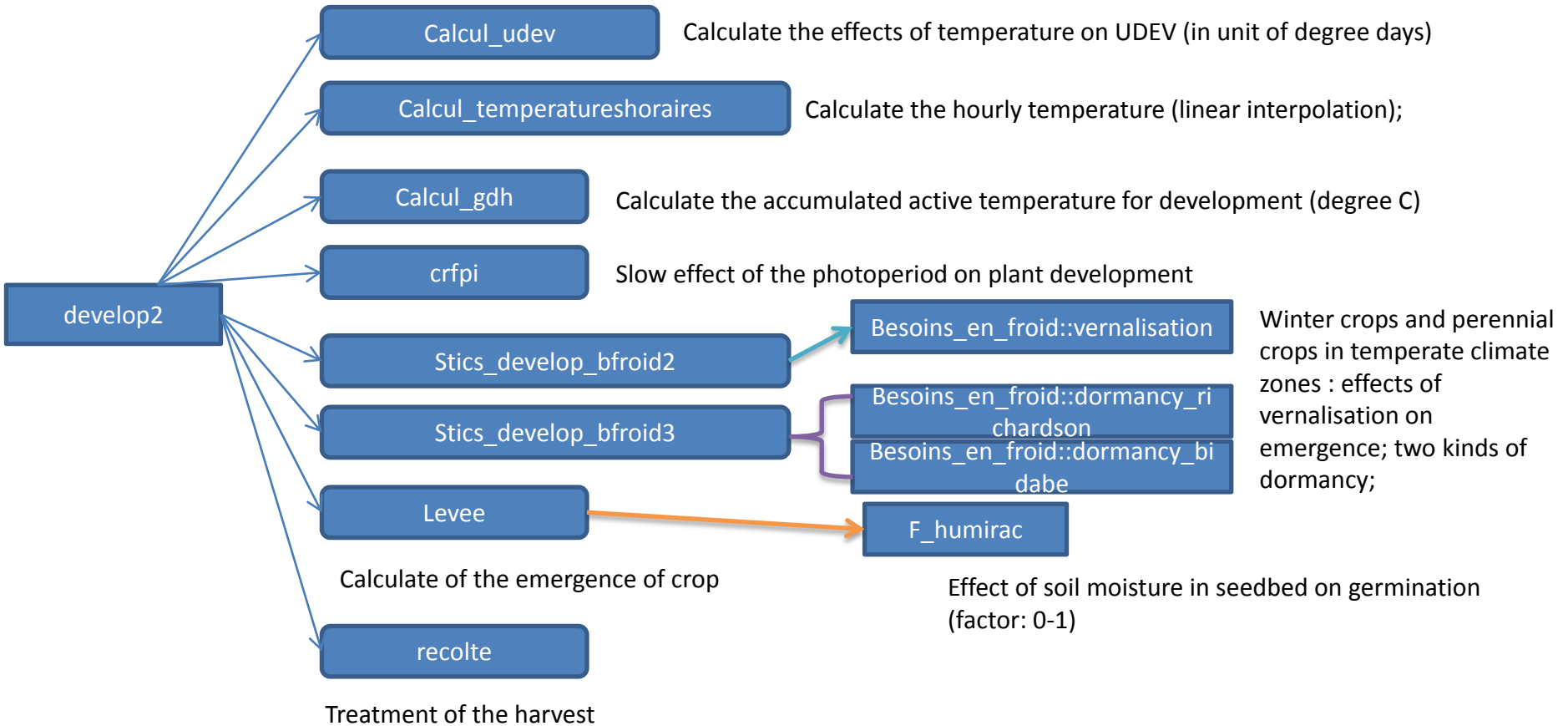# Focus on:

- LAI calculation:
  - ORCHIDEE: stomate.f90 (l. 3040-3062; LAI = biomass*sla);
  - STICS: laidev module;

Conceptual map for reorganizing the processes for calculating LAI

LAIdev

Recalcullevee (Ajust_Lai_Obs.f90)

Ajust the LAI curve to have a better representation of the realistic LAI curve.

Development::develop → develop2

Calculate the phenological stages of crop, e.g. emergence, dormancy and harvest, etc.

F_densite_equiv

Calculate an equivalent plant density for the understory crop which accounts for the presence of the dominant crop. (only used for intercropping)

calai → Callai_

Calculate the number of leaves

calculnombredefeuiles

residusapportsurfacesol

Update the C and N stocks at surface

residuparamdec

Address decomposation and humification rate of the organic residue

tauxrecouvrement → Tauxrecouvrement_

Calculate the ground cover; an alternative option for representing the LAI

Calculate the phenological stages of crop considering

Calcul_udev — Calculate the effects of temperature on UDEV (in unit of degree days)

Calcul_temperatureshoraires — Calculate the hourly temperature (linear interpolation);

Calcul_gdh — Calculate the accumulated active temperature for development (degree C)

crfpi — Slow effect of the photoperiod on plant development

develop2

Stics_develop_bfroid2

Stics_develop_bfroid3

Besoins_en_froid::vernalisation

Besoins_en_froid::dormancy_richardson

Besoins_en_froid::dormancy_bidabe

Winter crops and perennial crops in temperate climate zones : effects of vernalisation on emergence; two kinds of dormancy;

Levee

F_humirac

Calculate of the emergence of crop

Effect of soil moisture in seedbed on germination (factor: 0-1)

recolte

Treatment of the harvest

Leaf area growth (a subroutine)
-the growth of LAI is splited into two stages: growth and senescence

- Leaf area growth is driven by phasic development, temperature (different variables), and stress factors. It is also modified by the plant density (standing for the inter-plant competetion).

- Phasic development: a logistic function;

- Thermal function: crop temperature, and cardinal temperature;

- Density function: there is a threshold;

- Water and nitrogen effect: a factor [0 1];

- Indeterminate crop: tropic competition (tropic stress index);

- Determinate crop: maximal expansion rate threshold is calculated to avoid the unrealistic leaf expansion.

$DELTAI_I =$
$DELTAIdev*DELTAI_T*DELTAL_{dens}*DELTAI_{stress}$;
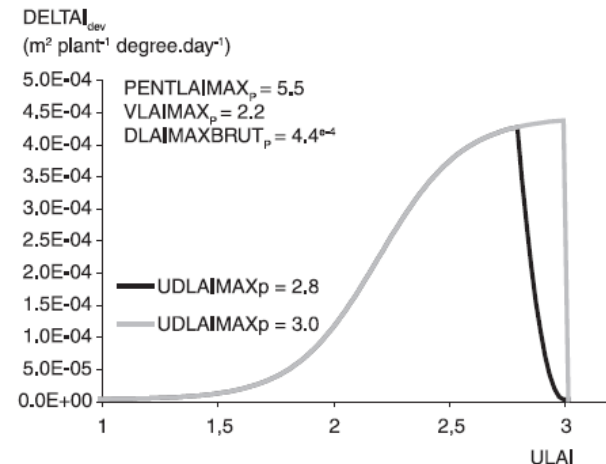
Tauxrecouvrement: do we need it?

- Calculate the ground cover;
- This is a simple alternative for the calculation of LAI, especially for some plants with complex leaf structure (e.g. lettuce).
- This subroutine is programmed in STICS as an alternative option.
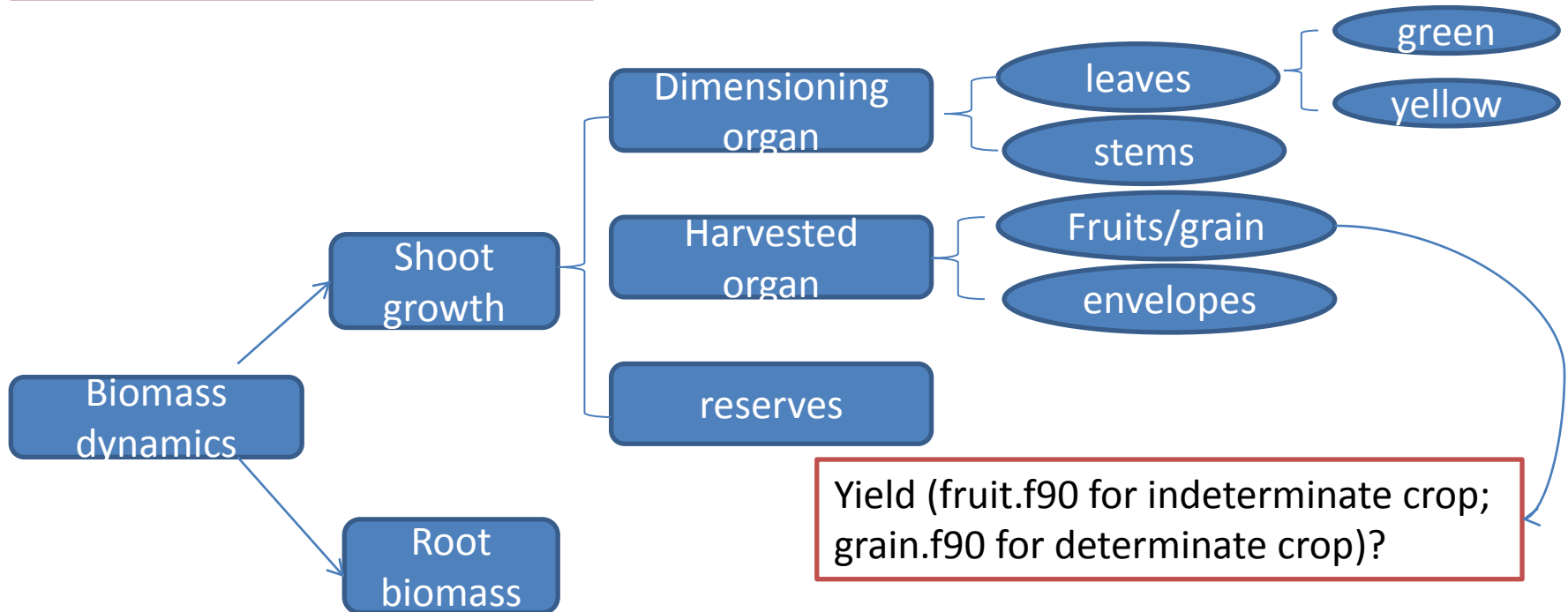
Main questions

- While running ORCHIDEE, in which level we call the "LAI subroutine box" of STICS to calculate the crop LAI;

- How do we prepare the variables which can not be calculated by ORCHIDEE itself? (include some other processes of STICS?)

Keep in mind

- Carbon allocation (Root, shoot);

- Irrigation effects;

- Crop_tem: microclimate: calcult.f90; (possible some errors in STICS codes regarding the Tcult)

- What is the relationship between growth and development?

- Management strategies;

Focus on the biomass dynamics

Dimensioning organ
- leaves
  - green
  - yellow
- stems

Harvested organ
- Fruits/grain
- envelopes

Shoot growth

reserves

Biomass dynamics

Root biomass

Yield (fruit.f90 for indeterminate crop; grain.f90 for determinate crop)?

Equations are all listed in the book.

1. Root growth (carbon? Related to carbon allocation) and profile (how can we use this process in ORCHIDEE? Water processes? Carbon partitioning in different soil layers);
2. Carbon allocation (yields, soil carbon, …);

Note: (Root depth calculation：stomate.f90 (l. 575-577))

Calculation of Tcult: (average(tcultmax, tcultmin))

- 1. empirical approach (when wind speed and air humidity are not available);
- 2. energy balance approach (two energy balances are calculated to estimate tcultmax and tcultmin, respectively);

tvar

Calculate the saturated vapor pressure at a given temperature

Calculate the net radiation

calrnet

rgex

Calculate the extraterrestrial radiation in MJ/m2/day

calcult

ratmo

Calculate the crop temperature

Calculate the atmospheric radiation

gsol