Concepts and tools for collaborative weed demographic modeling

Niels Holst
Århus University
Denmark

Archived at http://orgprints.org/17894

Acknowledgments

- European Network for the Durable Exploitation 0f Crop Protection Strategies (ENDURE)

- International Centre for Research in Organic Food Systems (ICROFS)

Weed modeling: Why?

- Proximate
  - fun
  - profitable
- Ultimate
  - science (research, education)
  - technology (tactics, strategy, policy)

Models are thinking tools

Models help us formulate notions about the dynamics of the different species that an ecosystem comprises.

AP Gutierrez 1996

Modeling for weed science

- Research
  - integration
  - analysis
  - idea generation
- Education
  - theory
  - practice

Models make you think

The purpose of models is not to fit data but to sharpen the questions.

S Karlin

A diversity of models

- 134 scientific papers
- 60 weed species
- 40 crops

Holst et al. (2007). Weed Research 47: 1-14.

Modeling life cycle

1. Formulate
2. Implement
3. Test
4. Publish

WeedML components

WeedML components

GALAP

SETVI

STEME

WeedML components

GALAP

SETVI

STEME

WeedML components

GALAP

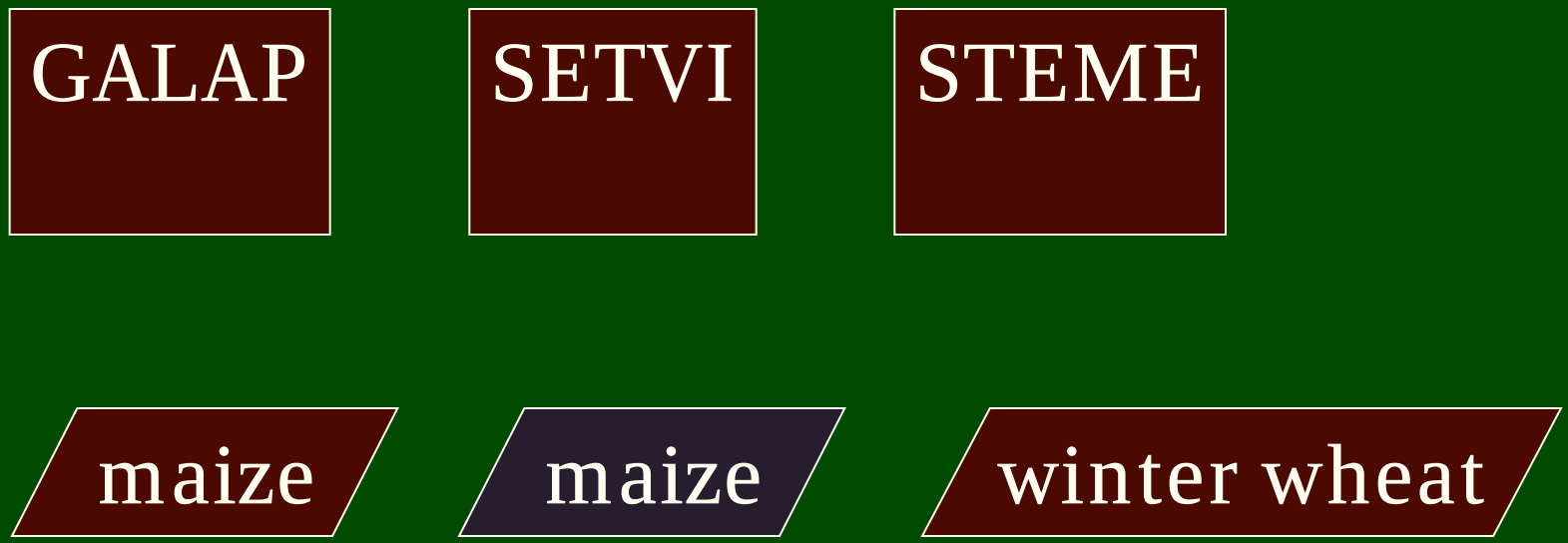
SETVI

STEME

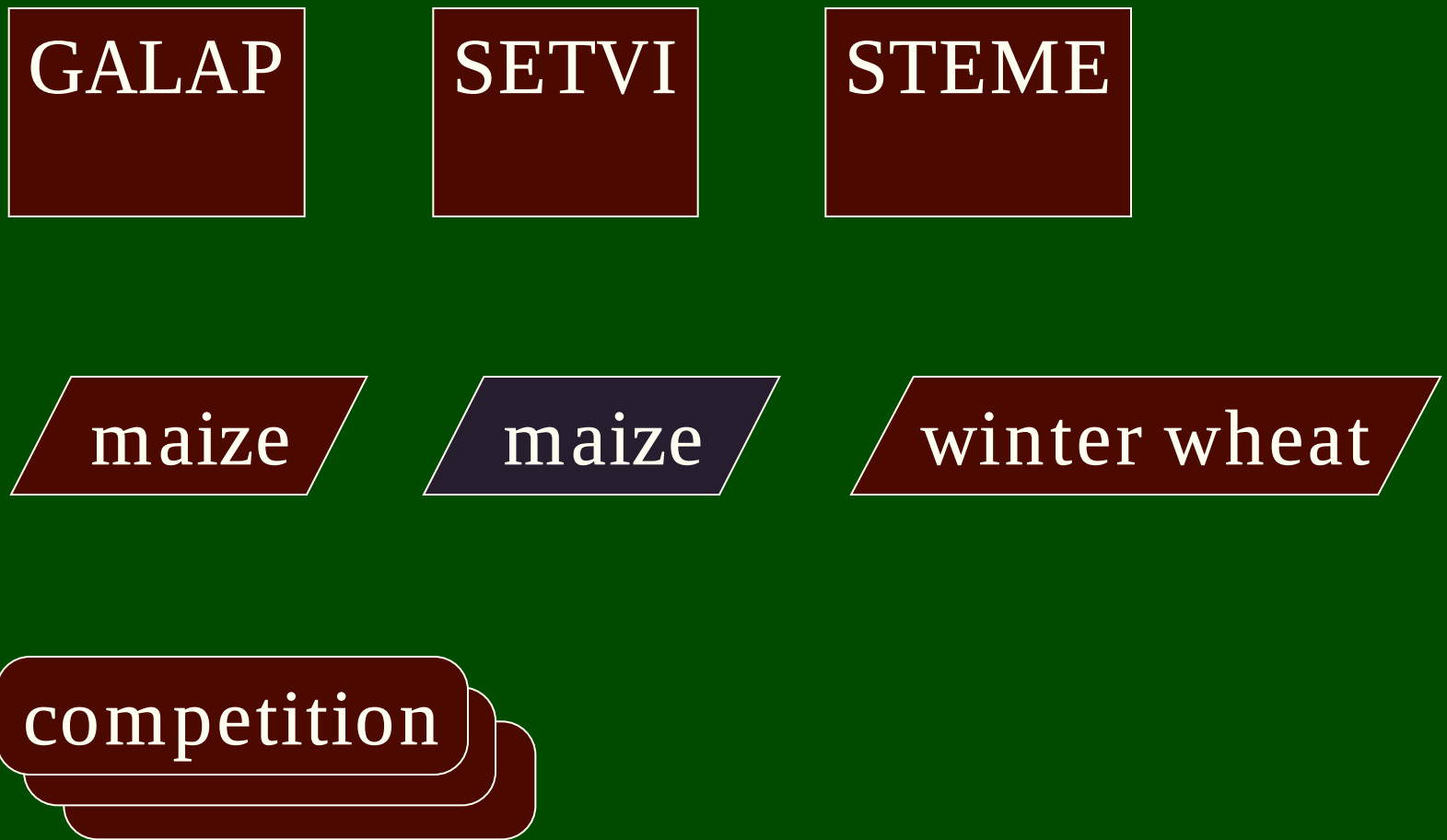
maize

winter wheat

WeedML components



WeedML components



WeedML components

GALAP

SETVI

STEME

maize

maize

winter wheat

hyperbolic

INTERCOM

WeedML ancestry

WeedML
Weed **M**arkup **L**anguage

SBML
Systems **B**iology **M**arkup **L**anguage

XML
e**X**tensible **M**arkup **L**anguage

<weedml version="1.0">

+ <model class="annual_weed" name="galap">

+ <model class="crop" name="winter_wheat">

+ <model class="competition::hyperbolic">

+ <model class="weather::log_file">

+ <output class="xy_plot">

</weedml>

<weedml version="1.0">

+ <model class="annual_weed" name="galap">

+ <model class="crop" name="winter_wheat">

+ <model class="competition::hyperbolic">

+ <model class="weather::log_file">

+ <output class="xy_plot">

</weedml>

<weedml version="1.0">

+ <model class="annual_weed" name="galap">

+ <model class="crop" name="winter_wheat">

+ <model class="competition::hyperbolic">

+ <model class="weather::log_file">

+ <output class="xy_plot">

</weedml>

```
<weedml version="1.0">
    + <model class="annual_weed" name="galap">
    + <model class="crop" name="winter_wheat">
    + <model class="competition::hyperbolic">
    + <model class="weather::log_file">
    + <output class="xy_plot">
</weedml>
```

<weedml version="1.0">

+ <model class="annual_weed" name="galap">

+ <model class="crop" name="winter_wheat">

+ <model class="competition::hyperbolic">

+ <model class="weather::log_file">

+ <output class="xy_plot">

</weedml>

<weedml version="1.0">

+ <model class="annual_weed" name="galap">

+ <model class="crop" name="winter_wheat">

+ <model class="competition::hyperbolic">

+ <model class="weather::log_file">

+ <output class="xy_plot">

</weedml>

<weedml version="1.0">

+ <model class="annual_weed" name="galap">

+ <model class="crop" name="winter_wheat">

+ <model class="competition::hyperbolic">

+ <model class="weather::log_file">

+ <output class="xy_plot">

</weedml>

```
<weedml version="1.0">
    + . . .
    <model class="weather::log_file">
        <parameter name="file" value="paris01.txt" />
        <parameter name="date" col="1" />
        <parameter name="temperature" col="2" />
        <parameter name="irradiation" col="4" />
    </model>
    + ...
</weedml>
```

<weedml version="1.0">

+ <model class="annual_weed" name="galap">

+ <model class="crop" name="winter_wheat">

+ <model class="competition::hyperbolic">

+ <model class="weather::log_file">

+ <output class="xy_plot">

</weedml>

```
<weedml version="1.0">
    + . . .
    <model class="crop" name="winter_wheat"
        from="doc(www.weedml.org/models/simple-
          winter-wheat.xml)" />
    + . . .
</weedml>
```

<weedml version="1.0">

+ <model class="annual_weed" name="galap">

+ <model class="crop" name="winter_wheat">

+ <model class="competition::hyperbolic">

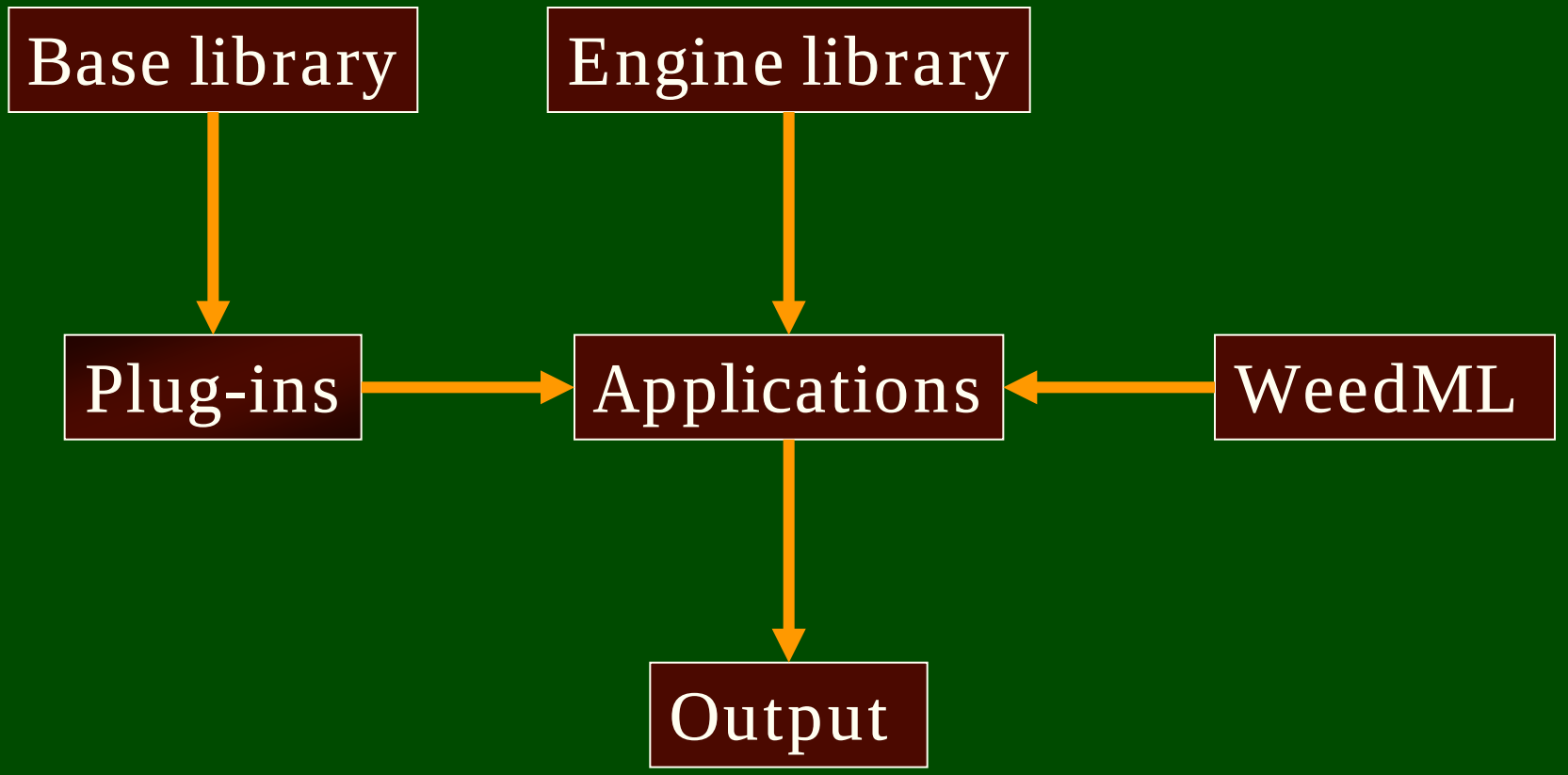
+ <model class="weather::log_file">

+ <output class="xy_plot">

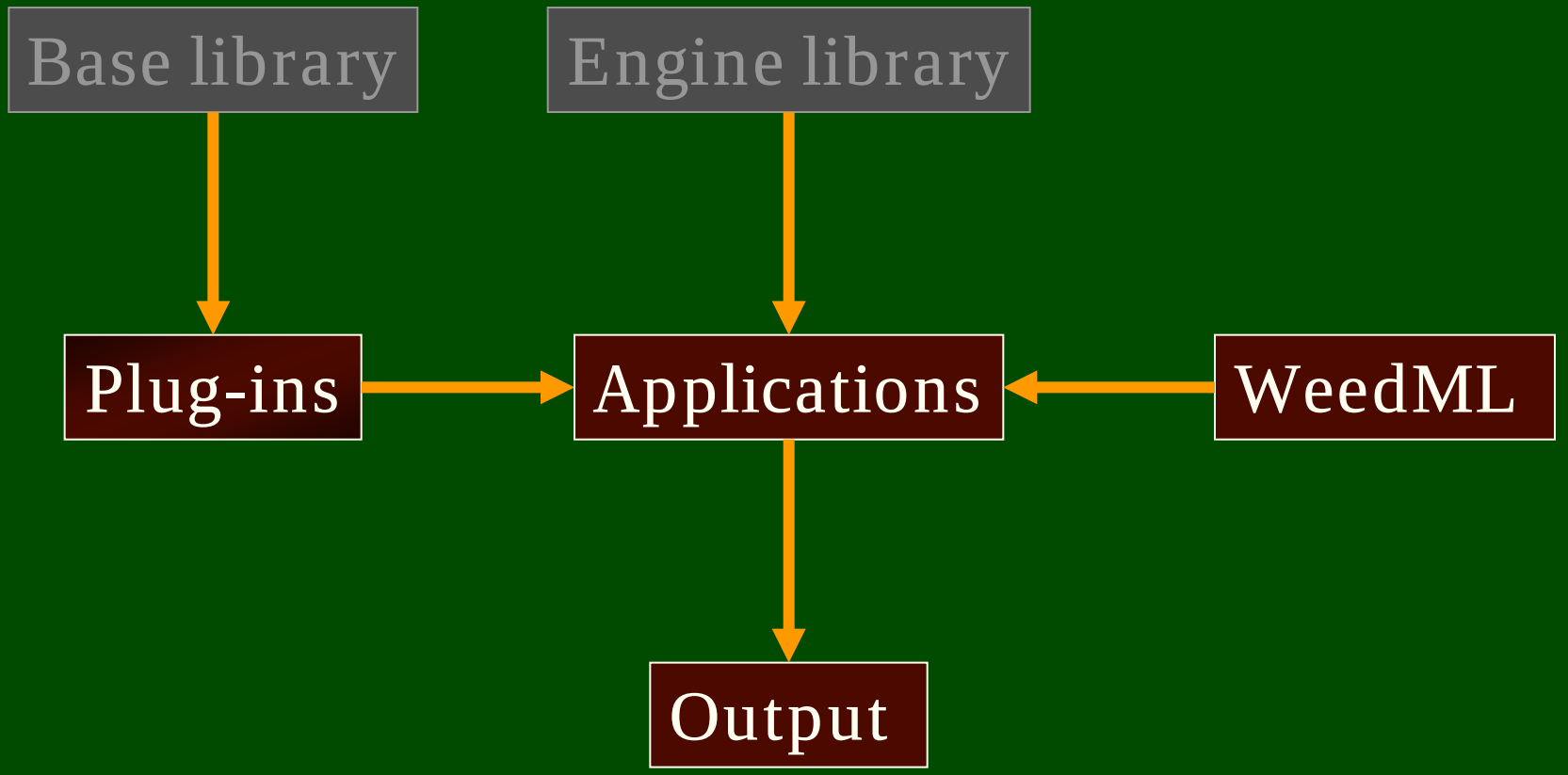
</weedml>

```
<weedml version="1.0">
    <model class="annual_weed" name="galap">
        + <model class="stage" name="seed">
        + <model class="stage" name="juvenile">
          <model class="stage" name="flowering">
              + <model class="reproduction">
              + . . .
          </model
    </model>
    + . . .
</weedml>
```

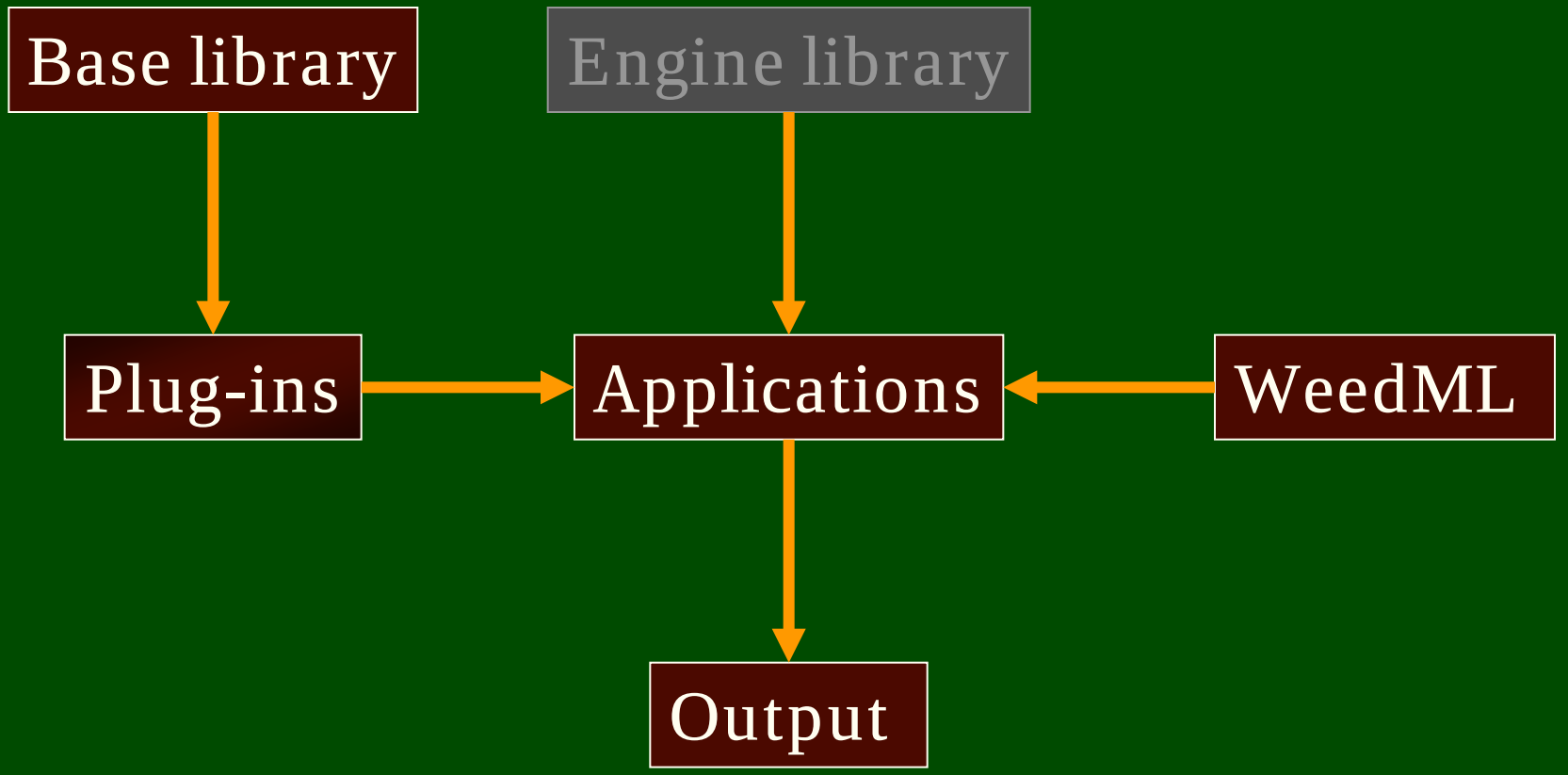
WeedML architecture



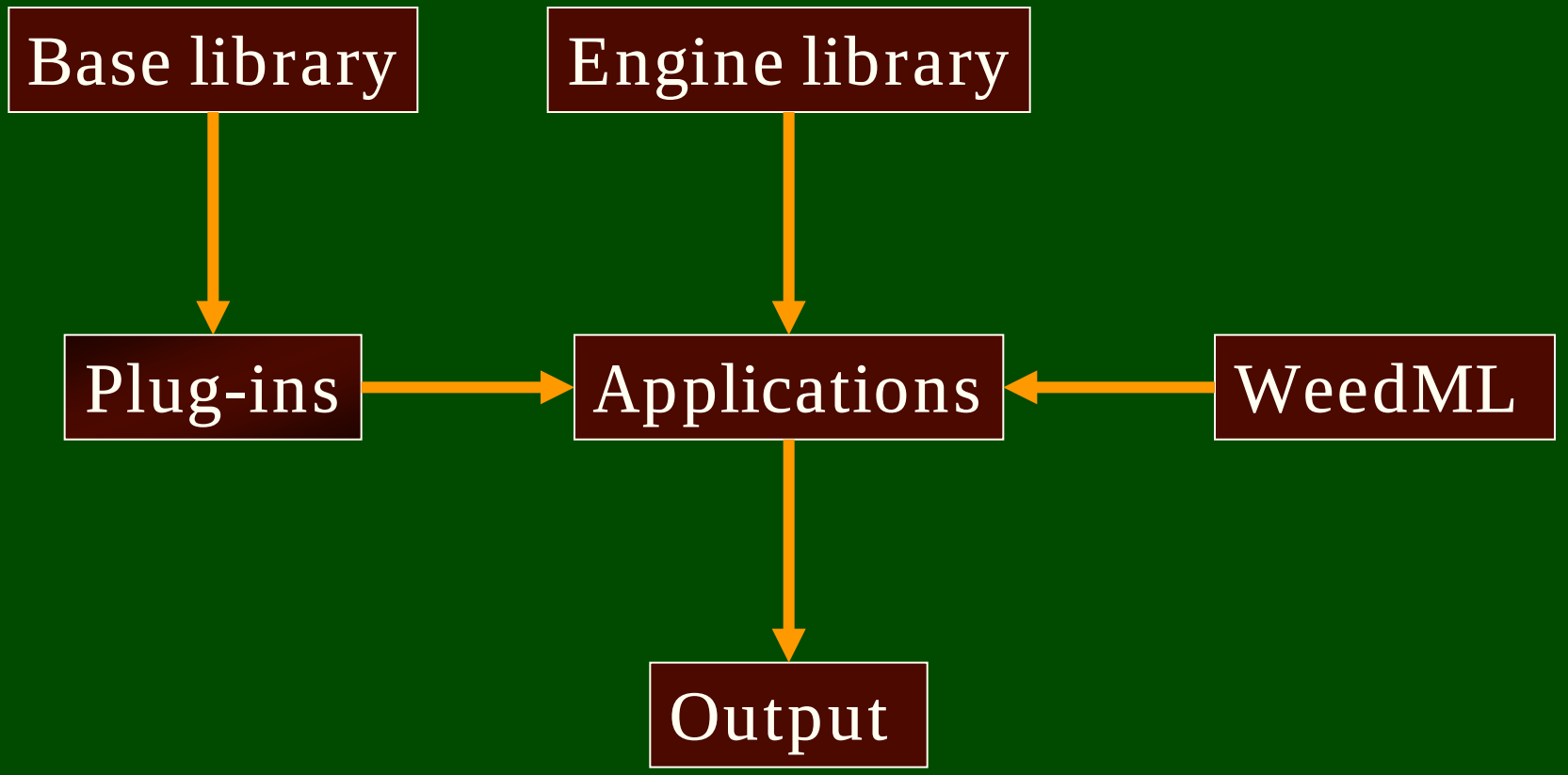
WeedML architecture



WeedML architecture



WeedML architecture



WeedML organisation

- www.weedml.org
  - applications
  - plug-ins
  - models
  - annual meetings
- weedml.sourceforge.net
  - source code